

Studies on western Atlantic Octocorallia (Coelenterata: Anthozoa). Part 3: The genus *Narella* Gray, 1870

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Abstract.—The seven species of *Narella* known from the North Atlantic are described and illustrated, often with the aid of stereo SEM photomicrographs in order to show the shape and relationships of the body wall sclerites. Two species are described as new: *N. alvinae* and *N. spectabilis*, the former the deepest known representative of this genus. Two keys, tabular and dichotomous, are provided for the seven species. The types of all but one of the species were examined; only photographs of the syntype were studied of *N. bellissima*. New material is reported for all but one species, based primarily on collections housed at the USNM and MCZ.

Like many primnoid genera, species of the genus *Narella* have very conspicuous polyps composed of a discrete number of large sclerites (scales), which are often delicately sculptured and arranged in a definite pattern and number. In most species there are only 16–18 sclerites in each polyp (exclusive of tentacular sclerites), which are always arranged in pairs. Even the eight opercular scales are paired across the sagittal axis. Species of *Narella* live exclusively in deep water (146–3419 m) and are found worldwide, including off Antarctica. One of the Atlantic species, *N. alvinae*, is the deepest known for this genus and the second deepest collected primnoid. Twenty-seven species of *Narella* are known: seven occurring in the Atlantic, 14 from the western Pacific, three from the Hawaiian Islands, one from the southwest Indian Ocean, one from the Galápagos, and one from off Antarctica.

Material and Methods

Most of the new specimens reported in the paper were collected by vessels operated by the University of Miami (*Columbus*

Iselin, *Pillsbury*, *Gerda*) and later deposited to the USNM. Other specimens were obtained from the MCZ (*Atlantis*) and ROM (*Alvin*).

Designation of polyp scales follows the terminology employed by Versluys (1906) as amplified by Bayer et al. (1983). Synonymies for all species are purported to be complete. The SEM photomicrographs were taken by the authors on a variety of SEM microscopes both at the University of Miami and the Smithsonian. Unprefaced SEM stub numbers pertain to the series of Bayer, those prefaced with a C, to the series of Cairns.

The following abbreviations are used: *Alb*—USFWS *Albatross*; *Atl*—*Atlantis* and R/V *Atlantis II* *BL*—U.S. Coast Survey Steamer *Blake*; *BM*—British Museum (now The Natural History Museum, London); *CI*—R/V *Columbus Iselin*; *G*—R/V *Gerda*; *H:W*—height to maximum width of an opercular scale; *JS*—Johnson-Smithsonian Deep Sea Expedition; *JSL-II*—R/V *Johnson Sea-Link II*; *MCZ*—Museum of Comparative Zoology, Harvard, Cambridge; *MOM*—Museum Oceanographique, Monaco; *O*—M/V, R/V *Oregon*; *P*—R/V *Pills-*

bury; ROM—Royal Ontario Museum, Ontario; *SB*—M/V, R/V *Silver Bay*; SEM—Scanning Electron Microscope stub number; USNM—United States National Museum (now the National Museum of Natural History, Washington, D.C.).

Subclass Octocorallia

Order Alcyonacea

Suborder Calcaxonia

Family Primnoidae Gray, 1858

Genus *Narella* Gray, 1870

Narella Gray, 1870:49 [type-species: *Primnoa regularis* Duchassaing & Michelotti, 1860, by monotypy].

Stachyodes Wright & Studer in Studer, 1887:49 [no species originally included; type-species: *Stachyodes regularis* Wright & Studer, 1889 (not Duchassaing & Michelotti, 1860), =*Stachyodes studeri* Versluys, 1906, by subsequent monotypy (Wright & Studer, 1889:54)].

Calypterinus Wright & Studer in Studer, 1887:49 [no species originally included; type-species: *Calypterinus allmani* Wright & Studer, 1889, by subsequent monotypy (Wright & Studer, 1889:53)].

Diagnosis.—Colonies of moderate size (up to about 50 cm), dichotomously branched in one plane or unbranched; polyps facing downward in whorls or pairs, rarely isolated; 3 or 4 pairs of large abaxial body scales, adaxial scales reduced to 1 well-developed buccal in each row, sometimes with 1 or 2 more below it; operculum consisting of 8 generally triangular scales each with a more or less distinct longitudinal keel on inner surface and corresponding trough on outer; tentacles usually with numerous flat rodlets; coenenchymal sclerites as scales, generally elongated, sometimes with raised external crests; axis heavily calcified, longitudinally grooved, with a discoidal basal holdfast attached to solid objects.

Remarks.—Versluys (1906) divided the species of *Narella* (as *Stachyodes*) into two groups, one with the sclerites of the basal

pair meeting at the adaxial (lower) side of the polyp to form a complete ring, the other not. However, as some of the specimens investigated for the present account have some polyps with “closed” basal scales and others with “open” basals, even on a single branch, it appears that this character is not reliable even at the specific level. It has therefore been omitted as a basis for classification.

One of the most diagnostic features at the species level among the Atlantic *Narella*, and perhaps among all the species of this genus, is the shape and sculpture of the body wall sclerites, especially the basal sclerites, each species having a unique architecture (shape) and surface texture (crests and/or granulation). But, this feature is difficult to determine, often requiring SEM or various staining techniques to see. Thus, the dichotomous key, designed for ease of use, does not emphasize that character, rather the grosser characters such as the branched or unbranched nature of the colony. Unfortunately, branching characteristics can be misleading, in that long branches of a branched colony are often collected separated from the main colony, falsely suggesting that such a detached branch is an unbranched colony. Thus, we recommend favoring the tabular key (Table 1) for identification purposes, which gives a suite of characters for every species, including aspects of the basal sclerite architecture and texture.

The four pairs of opercular sclerites of all species of *Narella* appear to follow a similar pattern of size and shape. Sclerites of the adaxial pair are always the smallest in height and width (usually at least twice as tall as the basal width, shaped like an isosceles triangle) and are symmetrical in shape. The scales of the inner- and outer-lateral pairs are progressively taller and wider and asymmetrical, the adaxial side of each scale produced as a “shoulder” that overlaps the edge of the scale to its adaxial side. The abaxial operculars are invariably the largest of the operculars, both in height

and width, the widest part occurring at about mid-height (often resembling the playing card spade) and are symmetrical, having projecting shoulders on both edges. The triangular shape of the operculars invariably changes in the ad- to abaxial direction, such that the ratio of height to maximum width decreases, essentially changing form isosceles to almost equilateral triangular. This ratio of height to maximum width is often species specific and thus the term H:W is introduced herein to define this shape for the opercular scales.

Key to the Seven Atlantic Species of *Narella*

- 1. Polyps with 3 pairs of large body scales 2
- 1'. Polyps with 4 pairs of large body scales 6
- 2. Colonies unbranched 3
- *N. versluysi* (Hickson, 1909)
- 2'. Colonies branched, sometimes sparingly so 3
- 3. Colonies dichotomous branched in a lyriform pattern; opercular scales covered in abaxial view 3
- *N. bellissima* (Kükenthal, 1915)
- 3'. Colonies dichotomous branched, but not in a lyriform pattern; opercular scales visible 4
- 4. Distal margin of upper (i.e., "abaxial") part of basal scales projecting conspicuously as a pair of broad, flat, truncated or rounded lobes standing approximately normal to axis; lateral part of basal scales abruptly meeting upper ("abaxial") part at about 90°, ridged; sparingly branched *N. alvinae*, n. sp.
- 4'. Distal margin of basal scales projecting only as a pair of short, rounded lobes, oriented downward to axis; lateral part of basal scales meeting as smooth curve, not a 90° angle and not ridged; regularly and profusely branched 5
- 5. Whorls of polyps closely placed, 10–12 in 3 cm of axial length; 5 or more polyps per whorl; outer surface of large body scales rough, closely covered by small, sharp granules *N. regularis* (Duchassaing & Michelotti, 1860)
- 5'. Whorls of polyps more distantly spaced, 7–9 in 3 cm of axial length; usually 3 (2–4) polyps per whorl; outer surface of large body scales smooth except for more or less conspicuous radial wrinkles *N. pauciflora* Deichmann, 1936
- 6. Colonies sparingly branched dichotomously in one plan; polyps in whorls of 3–5, with 5–7 whorls in 3 cm of axial length; body scales without longitudinal crests *N. laxa* Deichmann, 1936
- 6'. Colonies apparently unbranched; polyps in whorls of 4, with 8 whorls in 3 cm of axial length; body scales with longitudinal crests *N. spectabilis*, n. sp.

Narella bellissima (Kükenthal, 1915)
Figs. 1A, 2A–C, 3A–D, 14

Not *Primnoa trilepis* Pourtalès, 1868:130.
Stachyodes trilepis.—Studer, 1901:41–42, pl. 5, pl. 11, figs. 3, 6, 7.
Stachyodes sp.—Versluys, 1906:123–124.
Stachyodes bellissima Kükenthal, 1915: 154; 1919:457; 1924:310.
Stachyodes regularis.—Kükenthal, 1919: 466–467 (specimen from St. Vincent at 88 fms, BL-232).
Stachyodes Allmani.—Thomson, 1927:29.
Narella regularis.—Deichmann, 1936:169, pl. 26, fig. 3.—Tixier-Durivault & d'Hondt, 1974:1412.—Grasshoff, 1982a: 738, map 3; 1982b:947, figs. 15–17.
Narella bellissima.—Grasshoff & Zibrowius, 1983: in part, 122–123, pl. 4, figs. 17–18 (not page 120, pl. 2, fig. 8).—Carpine & Grasshoff, 1985:33.—Grasshoff, 1986:26–27.

Material examined.—Mona Passage: 18°12'N, 67°42'W, 515 m, O-2644, 5 Oct 1959, 3 colonies almost complete save for holdfast, USNM 52776 (*SEM* 378, 1734, unnumbered stub made in 1971, C1031).

Off St. Vincent: 13°20'N, 61°02.5'W, 576–823 m, P-881, 6 Jul 1969, one small colony almost complete but lacking holdfast, USNM 52777 (*SEM* 380, 1723).

West of Puerto Rico: 18°03'45"N, 67°48'10"W, 439–549 m, JS-43, 11 Feb

Table 1.—Distinguishing characteristics of the seven Atlantic species of *Narella*.

| | Pairs of body scales | Branching | Number of whorls/3 cm | Number of polyps/whorl | Polyp size (mm) | Distal margin of basal scale | Ring of adaxial basal scales | Body wall scales: texture; ridging |
|-----------------------|----------------------|-------------------------------------|-----------------------|------------------------|-----------------|---|------------------------------|--|
| <i>N. bellissima</i> | 3 | Dichotomous (lyriform) | 10–13 | 3–5–8 | 2.0–2.2 | Prominent lobes, projecting perpendicular to axis | Closed | Smooth (low radiating granulation); basals slightly ridged at corners |
| <i>N. regularis</i> | 3 | Dichotomous (not lyriform) | 11–13 | 4–5 | 2.0–2.3 | Inconspicuous lobes, inclined downward 60° | Open | Coarsely granular; all body wall scales longitudinally ridged |
| <i>N. pauciflora</i> | 3 | Dichotomous (not lyriform) | 6–7–9 | 2–3–5 | 2.6–2.8 | Inconspicuous lobes, inclined downward 70° | Open | Smooth; prominent radially arranged ridges |
| <i>N. alvinae</i> | 3 | Dichotomous, but sparingly branched | 7 | 4 | 2.7–3.1 | Prominent lobes, perpendicular | Open | Smooth; basals prominently ridged at corners |
| <i>N. verstyisi</i> | 3 | Unbranched | 8–10 | 4–7* | 3.2–3.7 | Prominent lobes, inclined downward 60° to perpendicular | Open | Granular; no external ridges |
| <i>N. laxa</i> | 4 | Dichotomous, but sparingly branched | 5–7 | 3–5 | 3.0 | Inconspicuous lobes, perpendicular | Open | Coarsely granular; no external ridges |
| <i>N. spectabilis</i> | 4 | Unbranched (?) | 8 | 4 | 3.5 | Inconspicuous lobes, perpendicular | Closed | Granular; prominent longitudinal ridges at corners of all body wall scales |

Table 1.—Continued.

| | Opercular visible in adaxial view | H: W of abaxial opercular | Pairs of adaxial buccal scales | Other distinctive characters | Distribution and depth |
|-----------------------|-----------------------------------|---------------------------|--------------------------------|--|--------------------------------------|
| <i>N. bellissima</i> | No | 0.81–1.0 | 1+ | Buccal scales quite long; abaxial operculars quite short | Amphi-Atlantic; 161–1968 m |
| <i>N. regularis</i> | Yes | 1.45–1.55 | 1 | | Lesser Antilles, Bahamas; 366–792 m |
| <i>N. pauciflora</i> | Yes | 1.3–2.0 | 1–2 (ridged) | Operculars deeply creased longitudinally | Antilles, Bahamas; 738–1473 m |
| <i>N. alvinae</i> | Yes | 1.25–1.45 | 1 | coenosteal scales prominently ridged | Bermuda; 3419 m |
| <i>N. verstuysi</i> | Yes | 1.2–1.3 | 1+ | Basal scales ridged interiorly | Amphi-Atlantic; 550–3100 m |
| <i>N. laxa</i> | Yes | 1.8–1.9 | 2–3 | Opercular scales flat in basal region | Amphi-Atlantic; 2980–3186 m |
| <i>N. spectabilis</i> | Yes | 2.1–2.6 | 2 | Abaxial operculars sometimes multi-tipped | Tongue of the Ocean, Bahamas; 1485 m |

* 9–14 in eastern Atlantic types.

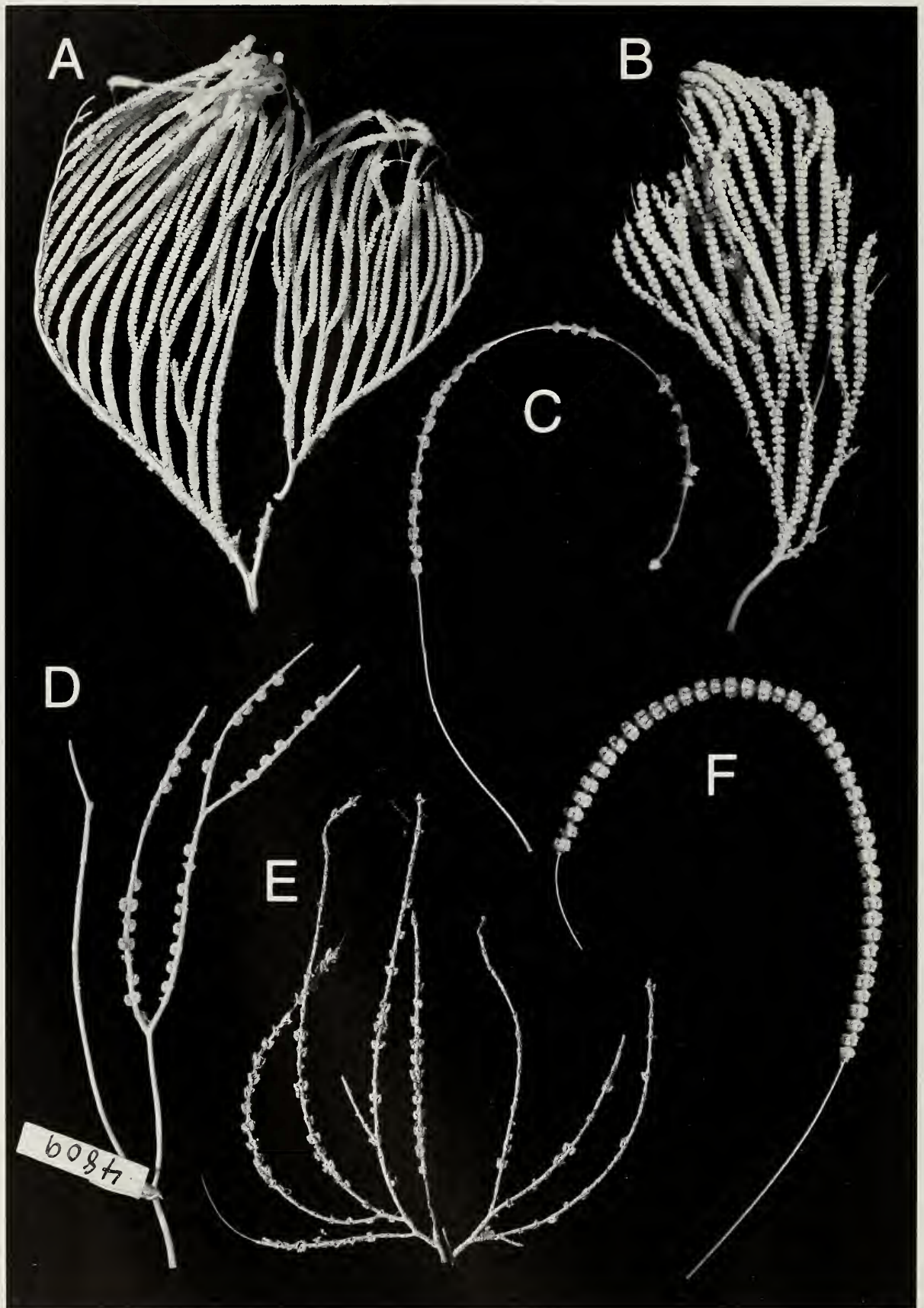


Fig. 1. A, *Narella bellissima*, O-2644, USNM 52776, colony in two pieces, $\times 0.33$; B, *N. regularis*, Alb-2752, USNM 49385, colony, $\times 0.50$; C, *N. spectabilis*, holotype, USNM 57578, $\times 0.67$; D, *N. pauciflora*, holotype, MCZ 4809, $\times 0.80$; E, *N. laxa*, holotype in two pieces, USNM 11853, $\times 0.55$; F, *N. versluysi*, CI-140, USNM 57570, $\times 0.55$.

1933, 3 dichotomous branches, the tallest 15.5 cm, USNM 54281 (*SEM* 412).

West of Puerto Rico: 18°17'05"N, 67°24'45"W, 512–622 m, JS-47, 13 Feb 1933, one nearly complete small colony with part of calcareous holdfast, and 6 detached branches, USNM 57444 (*SEM* 1726)

Bahamas, off Egg Island, Eleuthera: 25°30.85'N, 76°55.10'W, 790 m, *JSL-II*-813, 12 Apr 1984, branches cut from a large colony, USNM 1004869 (*SEM* 1727).

Bahamas, off Chub Cay, Berry Islands: 25°23.40'N, 77°55.25'W, 792 m, *JSL-II*-815, 13 Apr 1984, branches cut from a large colony, USNM 1004866 (*SEM* 1709, 1711).

Straits of Florida between Delray Beach, Florida, and Grand Bahama Island: 26°24'N, 79°36'W, 738 m, *CI-140*, 28 Sep 1973, one branch 14 cm tall, USNM 57568 (*SEM* 1733).

Off Northwestern Spain, Bay of Biscay: 44°11'N, 8°40'W, 450–500 m, *Thalassa* V807, 28 Oct 1968, 2 branches, USNM 94560 and 94561 (*SEM* 894, 1712–1716) (reported by Grasshoff, 1982b).

Lesser Antilles: *BL-232*, MCZ 4807, several colony and branch fragments now separated into 8 lots, alcohol and dry, previously reported as *N. regularis* by Deichmann (1936).

Lesser Antilles: *BL-233*, MCZ 4808, several branches now separated into two lots, alcohol, previously reported as *N. regularis* by Deichmann (1936).

Photographs of syntypes (MOM).

Types.—Four syntypes are deposited at the MOM, one in alcohol and three dry (Carpine & Grasshoff 1985), cataloged as 12 0011. Type Locality: *Hirondelle* station 105: 38°23'45"N, 30°51'30"W (off Azores), 927 m.

Description.—Colonies have a short, stout main stem, which bifurcates into 2 subsidiary branches, the angle between these two branches being 100°–110°, each of which give rise to a series of regularly spaced (every 12–15 mm) branches on their facing sides, altogether forming a uniplanar,

lyriform colony shape. The largest specimen examined (*O-2644*) has a main stem 2 cm in height and 5 mm in axial diameter, a total colony height of 43 cm, and approximately 14 branches that originate from each of the subsidiary branches. The branches originating from the two subsidiary branches are up to 28 cm in length, most of which bifurcate only once, some of which bifurcate twice, and several of which are unbranched. The axis is strongly calcified, fairly stiff, and golden-yellow in color; it bears fine longitudinal grooves. Polyps are arranged in whorls of 3–8 (average 5), the lower number characteristic of whorls at the ends of branches, the higher number found on larger-diameter basal branches. Whorls and polyps are so closely spaced that the branch coenenchyme cannot be seen, 10–13 whorls occurring in 3 cm branch length, the tips of the opercular scales almost touching the basal scales of the adjacent proximal polyp and the sides of each polyps touching their adjacent polyp in the same whorl. As is characteristic for the genus, the polyps point downward; the length of a polyp, as measured parallel to the axis from basal scale to the tip of the operculars, is 2.0–2.2 mm.

Each polyp is protected by three pairs of large abaxial body scales and a pair of small adaxial buccal scales. The pair of basal scales are quite prominent, standing perpendicular to the axis up to 1.8 mm in height, the upper half of each of these scales projecting above the medial scales as a tall, broad, rounded lobe. The sides of these basal scales curve around the base of the polyp and meet on the adaxial side in a ring structure, but do not fuse. At the point of curvature from the abaxial to lateral edges, there is usually a low longitudinal ridge on the lower half of the sclerite. The pair of medials are much smaller sclerites (0.7–0.8 mm in length), roughly square, and slightly creased transversely, resulting in a slight distal flare; they do not meet on the adaxial side. The pair of abaxial buccals are quite large (up to 1.3 mm in length and 0.90 mm

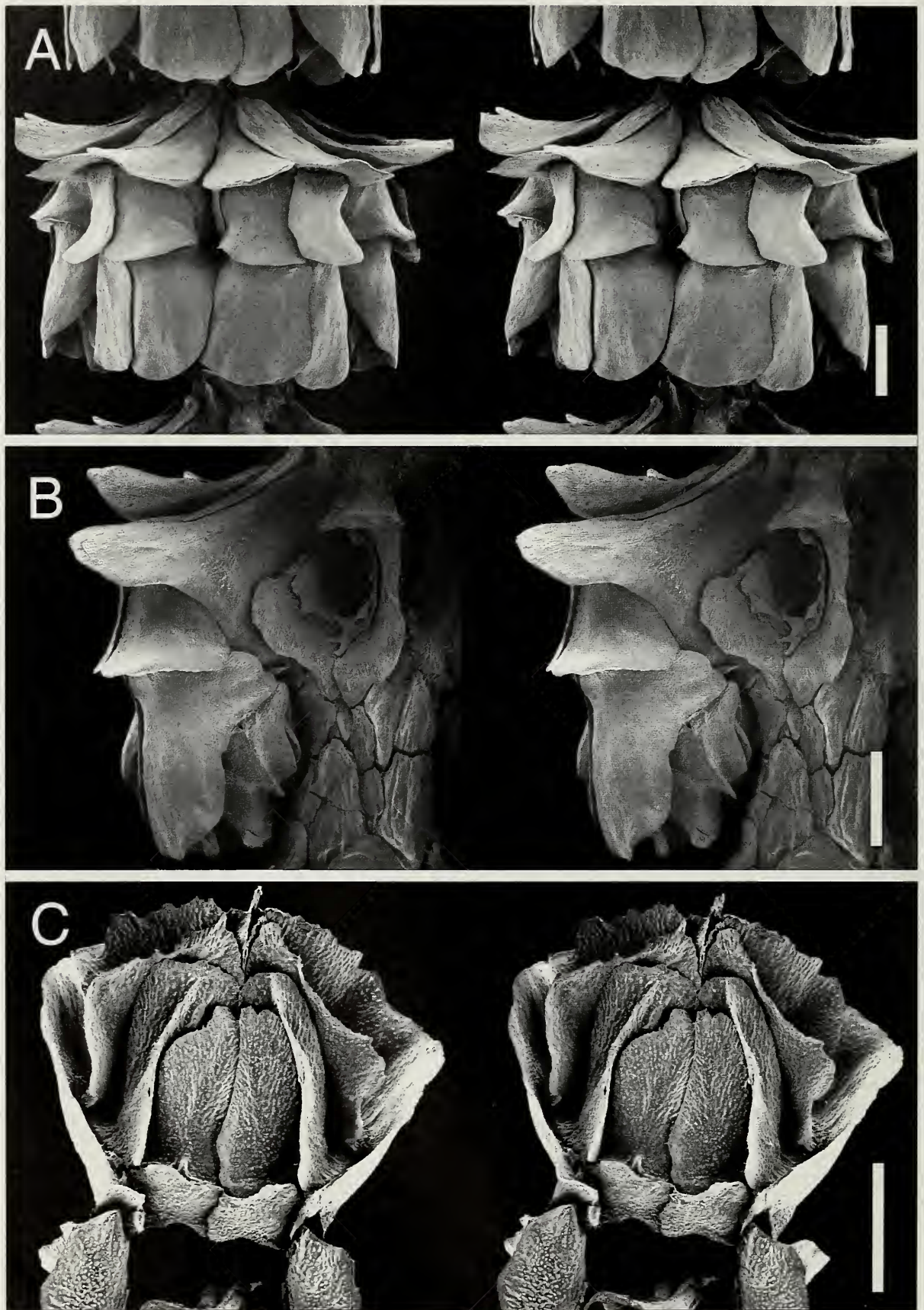


Fig. 2. *Narella bellissima*: A, B, JS-47, USNM 57444, a complete polyp whorl and lateral view of a polyp; C, JSL-II 815, USNM 1004866, adaxial view. Stereo views. All scale bars are 0.5 mm.

in width), and, although they do not meet on the adaxial side, form a protective cone enveloping the distal polyp and opercular scales, such that only the tips of the opercular scales can be seen from side or abaxial view. The distal edges of these buccals are quite thin and delicate, appearing translucent for the distal 0.1 mm because of a lack of tubercles on their inner surface of this region. The three pairs of large abaxial scales overlap each other slightly on the sagittal line and are covered by very small granules arranged in lines that radiate from a central point on each scale about $\frac{1}{3}$ the distance up from its base; however, the granulation is so fine that these scales appear smooth. A pair of quadrate-shaped adaxial buccal scales also occurs just beneath the adaxial operculars, these scales measuring about 0.3 mm in greater width. Their inner surface is tuberculate, the outer granular, and their distal edges finely serrate, the serrations being 2–6 μm in width. Rarely, one can observe in some specimens 10–12 pairs of vestigial adaxial scales that are elliptical in shape and only about 0.1 mm in greater diameter.

The adaxial operculars are elongate-triangular and symmetrical, up to 0.7 mm in height and 0.31 mm in basal width (H:W = 2.1–2.9). They are longitudinally concave, sometimes bearing a short medial ridge within this concavity, and also bearing a prominent medial keel on the distal half of its under surface. The inner- and outer-lateral and abaxial opercular scales are only slightly taller and wider (up to 0.75 mm tall and 0.47 mm wide: H:W about 1.3–1.6) and asymmetrical, such that there is a slight shoulder on the adaxial side, making the interior keel appear off-center. The abaxial operculars are only slightly taller but much wider than the laterals, sometimes wider than tall (e.g., 0.78 mm tall and 0.80 mm wide: H:W = 0.81–1.0) and symmetrical, bearing shoulders on each side at mid height, making the longitudinal interior keel centrally placed. The opercular scales have a progressively deeper longitu-

dinal groove exteriorly and a more prominent keel on their inner surfaces in the ad- to abaxial gradient. At first glance, in situ, it would appear that the operculars are flat with a medial ridge, but when disarticulated, it can be seen that these sclerites are deeply longitudinally grooved with a keel on lower face. When closed, the opercular scales form a tight, somewhat overlapping crown around the polyp, which is also protected by the abaxial buccals, all of which are directed toward the branch axis. The tentacles contain small (80 μm length), granulated, slightly curved spindles. The coenenchymal scales are elongate and irregular in shape, arranged in one layer, up to 1.2 mm in length, and usually longitudinally ridged. The inner surfaces of all sclerites are tuberculate, except for the distal edges of the body wall scales. The tubercles are roughly 10 μm in diameter and spiny, the individual spines being about 1 μm in diameter.

Comparisons.—*Narella bellissima* is the only Atlantic species in the genus to have dichotomous branching that results in a lyriiform colony. Based on Table 1, it is most similar to *N. alvinae*, both species having prominent lobate basal scales, but *N. bellissima* differs in having smaller polyps and consequently more whorls per cm, less prominent ridging on the body wall scales, proportionately longer buccal scales and smaller operculars resulting in the operculars being almost completely hidden from view, and occurs at a shallower depth.

Distribution.—Eastern Atlantic: Bay of Biscay off France and NW Spain (Grasshoff 1982b, 1986); off Portugal (Grasshoff 1986); Azores (Studer 1901, Tixier-Durivault & d'Hondt 1974); Madeira (Thomson 1927, Grasshoff 1982a); Canary Islands (Grasshoff & Zibrowius 1983); Cape Verde Islands (Grasshoff 1986); ?Dakar (Grasshoff & Zibrowius 1983); 225–1968 m. Western Atlantic: Lesser Antilles and Bahamas (Fig. 14); 161–792 m.

Remarks.—Studer (1901) was the first to describe and beautifully illustrate a speci-

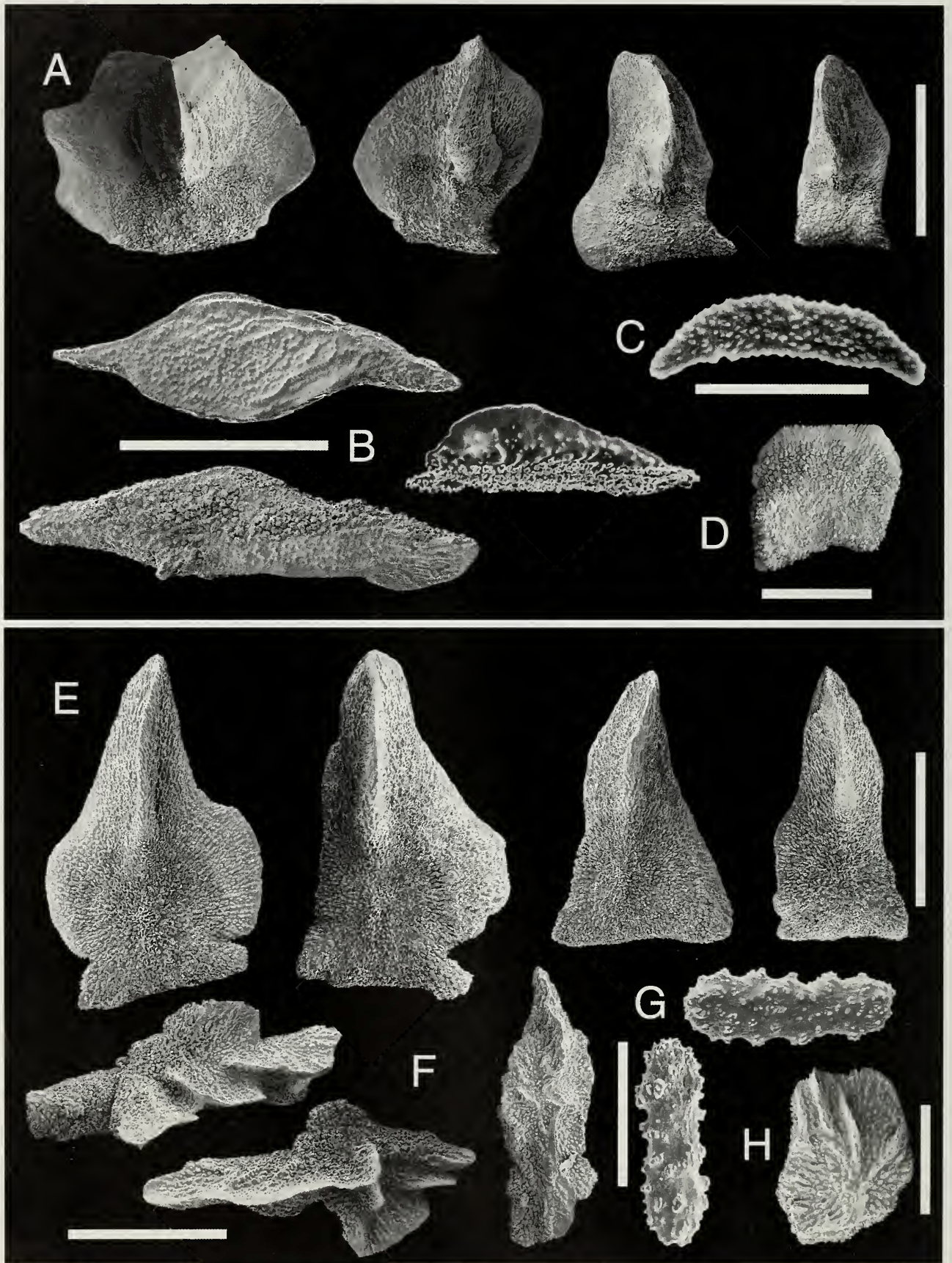


Fig. 3. A–D, *Narella bellissima* (A, B, D, O-2644, USNM 52776; C, P-881, USNM 52777): A, underside of abaxial, outer-lateral, inner-lateral, and adaxial opercular scales; B, three coenenchymal scales; C, a tentacular scale; D, an adaxial buccal scale. E–H, *Narella regularis* from Alb-2752, USNM 49385: E, underside of abaxial, outer-lateral, inner-lateral, and adaxial opercular scales; F, three coenenchymal scales; G, two tentacular scales; H, an adaxial buccal scale. Scale bars: A, B, E, F = 0.5 mm; C, G = 0.05 mm; D, H = 0.25 mm.

men of this species, but incorrectly identified it as *Stachyodes trilepis* (see Bayer, 2001). Versluys (1906) examined Studer's specimens, recognized the mistake, but, having examined only a small fragment of the type, declined to name it. He did note, and we concur, that Studer's illustration (Studer 1901:pl. 5) of the larger syntype, which was purportedly drawn at natural size, depicts the polyps at almost twice their normal size, and thus results in only half as many whorls per cm. Finally, Kükenthal (1915), in one line and one additional couplet in a key, provided the name *S. bellissima* for this taxon. He (Kükenthal 1919) later redescribed the species, but incorrectly reported the depth of capture as 1700 m, apparently misinterpreting the depth given by Studer in meters as fathoms. In the same paper, Kükenthal (1919) also reported *S. regularis* from St. Vincent, but examination of this specimen shows it to be typical *N. bellissima*. Likewise, examination of all the specimens reported as *N. regularis* by Deichmann (1936), which includes Kükenthal's specimen, shows them to be *N. bellissima*. Although widespread in the eastern Atlantic (see Distribution), these are the first correctly identified records of *N. bellissima* from the western Atlantic.

Histological sections prepared from samples of USNM 52772 specially fixed in Bouin's fixative confirm Studer's observation (1901:pl. 11, figs. 3, 6) on *Stachyodes trilepis* (= *Narella bellissima*) that the sulcal side of the polyps is abaxial. The longitudinal muscles of the mesenteries are very well developed, as would be expected in polyps capable of strong contraction and adaxial flexion, as illustrated by Studer (1901:pl. 11).

Narella regularis (Duchassaing & Michelotti, 1860)

Figs. 1B, 3E–H, 4A–C, 7

Primnoa regularis Duchassaing & Michelotti, 1860:17, pl. 1, fig. 12, 13.—Kölliker, 1865:135, pl. 17, fig. 13.—Duchassaing,

1870:13 (listed).—Wright & Studer, 1889:56.

Not *Stachyodes regularis* Wright & Studer, 1889:55 (junior secondary homonym, replacement name: *S. studeri* Versluys, 1906).—Kükenthal, 1919:466–467 (= *N. bellissima*).

Stachyodes regularis.—Versluys, 1906:96.—Kükenthal, 1924:316.

Not *Narella regularis*.—Deichmann, 1936:169.—Tixier-Durivault & d'Hondt, 1974:1412.—Grasshoff, 1982a:738, map 3; 1982b:947 (all = *N. bellissima*).

Narella regularis.—Bayer, 1956:F222, fig. 159,5.

Material examined.—Bahamas, off Chub Cay, Berry Islands: 25°23.40'N, 77°55.25'W, 792 m, *JSL-II-815*, 13 Apr 1984, 10 branches cut from a large colony, USNM 1004861 (SEM 1728).

Off northwestern Cuba: 23°10'N, 81°28'W, 366 m, *Atl-3480*, 11 May 1939, 1 branch 6 cm long, MCZ 3674.

Off northwestern Cuba: 23°12'N, 81°22'W, 777 m, *Atl-3469*, 9 May 1939, 2 large colonies (one 45 cm tall and 11 mm in basal stem diameter), MCZ 3601.

Off St. Vincent: 13°34'00"N, 61°04'00"W, 514 m, bottom temperature 8.4°C, *Alb-2752*, 4 Dec 1887, 4 nearly complete colonies and 4 detached branches, USNM 49385 (SEM 381, 376, C1032).

Holotype (see below).

Types.—The holotype of *P. regularis* is deposited at the Museo Regionale di Scienze Naturali, Turin (Coel. 275), but all polyps had fallen from the axis, making it difficult to characterize the species. Type Locality: Guadeloupe, Lesser Antilles, depth unknown.

Description.—Colonies have a short main stem, above which they are equally and dichotomously branched at approximate intervals of 15–25 mm, resulting in a uniplanar (not lyrate) fan. The largest colony examined (*Alb-2752*) has a main stem of at least 3.5 cm (but is broken from the substrate) and 2.7 mm in axial diameter, a

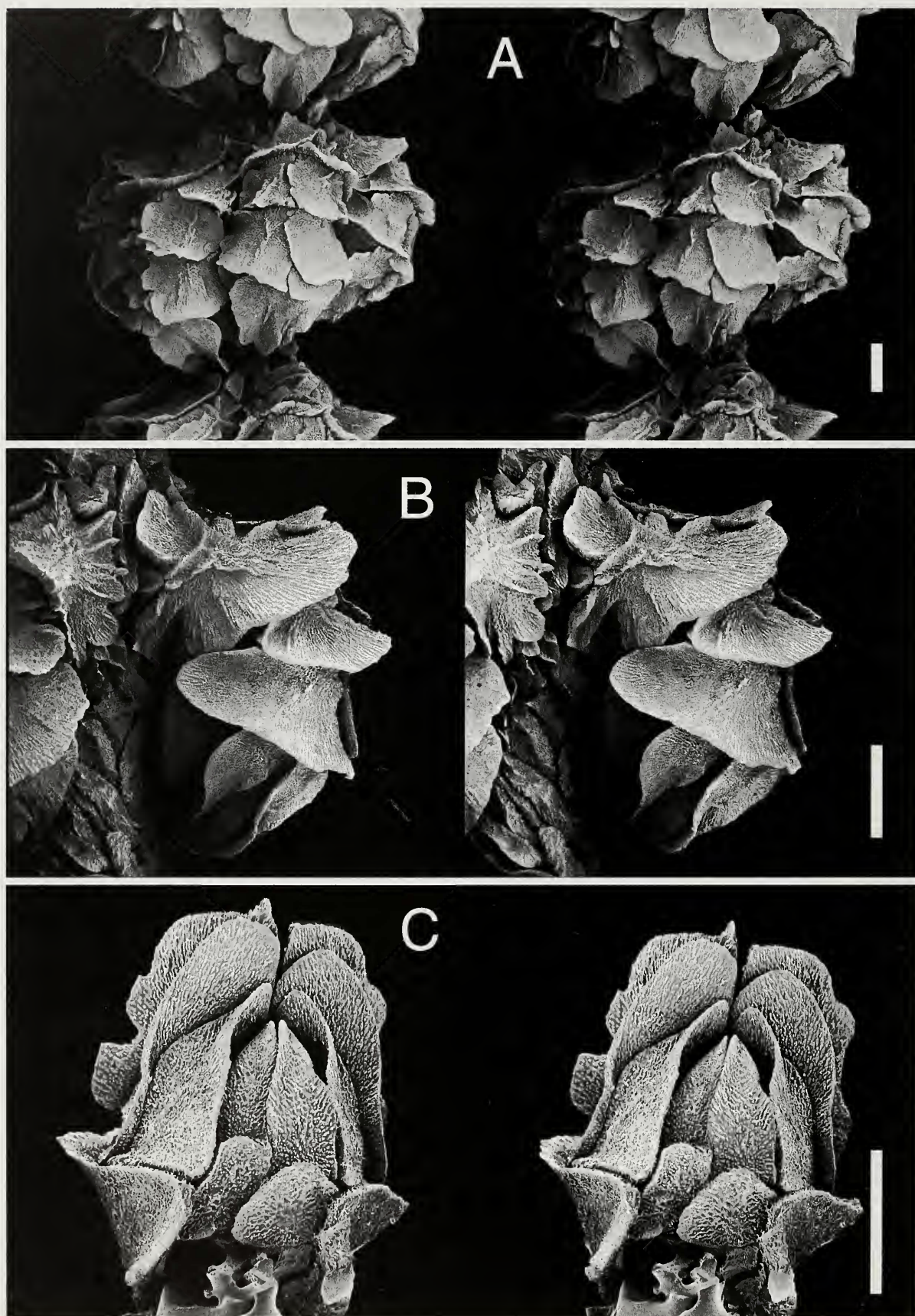


Fig. 4. *Narella regularis* from Alb-2752, USNM 49385: A, a complete polyp whorl; B, polyp in lateral view; C, polyp in adaxial view. Stereo views. All scale bars are 0.5 mm.

total colony height of 19 cm, and 37 terminal branchlets, the longest branchlet the result of 7 bifurcations. The axis is heavily calcified, fairly stiff and golden-yellow in color. Polyps are arranged in whorls of 4 or 5, the predominant number being 5. Whorls of polyps are fairly closely spaced, such that 11–13 whorls occur in 3 cm branch length, the tips of the opercular scales separated by about 0.45 mm from the basal scale of the adjacent polyp. The sides of each polyp do not touch each other, but are separated by 0.1–0.2 mm. The downward pointed polyps measure 2.0–2.3 mm in length parallel to the axis.

Each polyp is protected by 3 pairs of large abaxial body scales and a pair of smaller adaxial buccals. The sclerites of the basal pair project at a downward angle of about 60° from the axis and are about 1.25 mm in height, only the distal 0.1–0.2 mm extending beyond the junction with the medials. The basal scales curve around the body of the polyp but do not meet on the adaxial side. The pair of medials are much smaller (e.g., 0.50–0.65 mm long) and narrower, projecting at a downward angle of about 45° from the axis and having a distal outwardly flared margin. The abaxial buccals are slightly more elongate (e.g., 0.70–0.80 mm) and much broader, oriented essentially parallel to the branch axis and forming a cone that encircles only the very base of the opercular scales. The outer surface of the sclerites is distinctly roughened by close-set, sharp granules which impart a rough, shagreen-like appearance, and the inner surface where in contact with the mesogloea, by crowded, complex tubercles. The basal pair of body scales is ornamented by several sharply raised irregular ridges radiating from the depositional center or “nucleus,” and similar, but less conspicuous, ridges mark the outer surface of the medial and buccal scales as well. The pair of small adaxial buccals are rhomboidal in shape, about 0.40 mm in greater diameter, and have a finely serrate distal edge.

The adaxial operculars are symmetrical

isosceles triangles, varying in height from 0.6 to 0.9 mm and up to 0.45 mm in basal width (H:W = 2.0–2.2). The inner- and outer-lateral operculars are larger (up to 1.0 mm tall and 0.65 mm wide: H:W = 1.5–1.7) and asymmetrical, a bearing a slight shoulder on their adaxial side. The largest (i.e., abaxial) operculars are symmetrical, up to 1.1 mm in height and about 0.75 mm wide (H:W = 1.45–1.55). They are slightly notched basally, thus resembling certain Indian arrowheads. Thus all operculars, although differing in size and symmetry, have roughly the same H:W ratio, and all bear a longitudinal groove on their exterior surface and a prominent keel on their interior surface. All of the opercular scales are easily seen in side view, except for the very base, which is protected by the abaxial buccals. The tentacles contain small (65–75 μm long and about 20 μm wide), straight, granular rodlets. Coenenchymal scales are elongate and somewhat irregular in shape, arranged in one layer, up to 0.75 mm in length, and ridged, the ridges sometimes anastomosing on the surface.

Comparisons.—In addition to those characters mentioned in Table 1, *N. regularis* differs from *N. bellissima* in having larger, consistently triangular opercular scales (H:W always >1.5), which are largely unprotected by the abaxial buccal scales; a curved polyp, instead of one that is parallel to the branch axis; a smaller ratio in length of their buccal scales in relation their medial scales; lacking a distal translucent region; basal scales that do not meet on the adaxial side; and more highly ridged body wall and coenenchymal scales, the ridges of the latter sometimes anastomose.

Distribution.—Lesser Antilles, Bahamas, off Cuba (Fig. 7); 366–792 m.

Remarks.—Eliminating the misidentifications and simple listings of this species, as indicated in the synonymy, these are the first legitimate records of *N. regularis* subsequent to its description.

Narella pauciflora Deichmann, 1936

Figs. 1D, 5A–C, 6A–D, 7

Narella pauciflora Deichmann, 1936:170, pl. 25, fig. 3, pl. 26, fig. 2.

Material examined.—Off Morro Light, Cuba: 1473 m, *BL-2*, date, 3 branches, MCZ 4807?.

Off Campeche Bank, Mexico: 23°52'N, 88°58'W, 1473 m, *BL-35*, date, 1 complete colony and several branches, MCZ 4814, 4814a.

NW of Cardenas, Cuba: 23°54'N, 81°27'W, 1153–1190 m, *G-375*, 17 Sep 1964, several badly damaged branches retaining only a few polyps, USNM 52771.

Off northwestern Cuba: 23°24'N, 81°00'W, 676–1106 m, *Atl-2995*, 16 Mar 1938, 3 colony fragments, MCZ 3872.

Off northwestern Cuba: 23°22'N, 81°05'W, 859–1216 m, *Atl-2996*, 16 Mar 1938, 3 colony fragments, MCZ 3831.

South of Cay Sal Bank: 23°51.9'N, 80°42.7'W, 1079–1089 m, *G-1111*, 30 Apr 1969, 9 branches, the largest 19 cm tall, USNM 52772 (SEM 377, 377A, C1013).

N of Cardenas, Cuba: 23°51'N, 81°02'W, 1107–1162 m, *G-372*, 16 Sep 1964, 2 branches, the larger 12 cm tall, with one bifurcation, the other unbranched and partly denuded, USNM 52773.

NE of Havana, Cuba: 23°45'N, 81°49'W, 1400–1395 m, *G-965*, 1 Feb 1968, 5 broken branches, the largest 21 cm tall, with ophiuroids attached, cortex and polyps rubbed off in several places, USNM 52774.

Off St. Lucia: 14°17'N, 60°45.2'W, 1280 m, *P-892*, 7 Jul 1969, 3 branches, the largest 27 cm tall with several bifurcations, apparently about half of a colony, without holdfast, severely damaged, with attached ophiuroids, USNM 52775 (SEM 1729).

Tongue of the Ocean, Great Bahama Bank: 24°02'N, 77°17'W, 1335 m, *CI-19*, 6 Jul 1972, one nearly complete colony with part of calcareous holdfast, 31 cm tall, terminal branchlets broken off, ophiuroid attached, dry, USNM 57571 (SEM 1704); 5 branches, the largest 22 cm tall, and smaller

fragments more or less damaged, with ophiuroid attached, USNM 57572.

Tongue of the Ocean, Great Bahama Bank: 23°29'N, 77°05'W, 1234 m, *CI-46*, 24 Feb 1973, several badly broken fragments, the largest about 18 cm tall, with ophiuroids attached, in alcohol, USNM 57573 (SEM 406, 1730).

Tongue of the Ocean, Great Bahama Bank: 23°40'N, 77°08'W, 1372 m, *CI-47*, 24 Feb 1973, one badly damaged branch about 10 cm tall, most polyps lost, USNM 57574.

Straits of Florida between Delray Beach, Florida, and Grand Bahama Island: 26°24'N, 79°36'W, 738 m, *CI-140*, 28 Sep 1973, 6 broken branches severely decorticated, the largest 23 cm tall, USNM 57575.

NE of San Juan, Puerto Rico: 18°40'N, 65°58'W, 1446–1510 m, *P-830*, 4 Feb 1969, several broken branches, the largest 12 cm tall, and decorticated fragments, with ophiuroids attached, USNM 57577.

Locality unknown: unknown *Blake* station, 3 branches, MCZ 4813.

Types (see below).

Types.—The holotype (*BL-124*, MCZ 4809) consists of one branch 13 cm long and several smaller branches preserved in alcohol. The paratypes (*BL-227*, MCZ 4810 and 4810a) consist of one broken colony and several branches, also preserved in alcohol. Type Locality: 17°47'30"N, 64°53'45"W (off St. Croix), 1061 m.

Description.—Colonies have a stout main stem that is entirely calcified (white) and which bifurcates repeatedly in a fairly regular fashion (dichotomous branching) resulting in a uniplanar colony. The largest specimen (*CI-19*) is 31 cm tall, having a calcified basal stem 13 mm in diameter and 24 mm in height. Branching is fairly sparse, branch segments between branching nodes are 10–50 mm in length, and the longest terminal branch is 14 cm, the distal most branch being the result of 6 successive bifurcations. The angle between branches is only 25°–30°. Above the calcified base, branches are fairly stiff, golden-yellow in

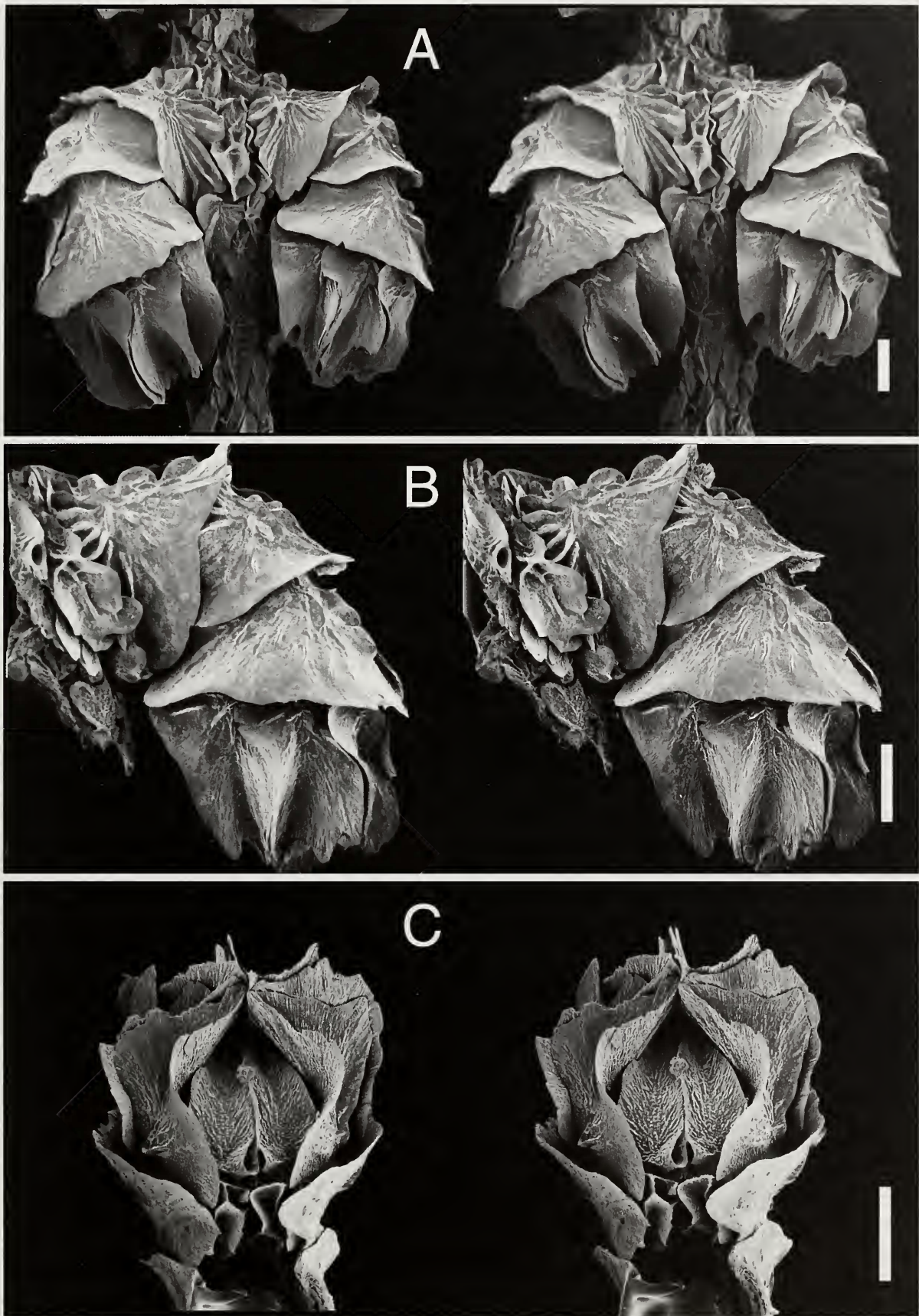


Fig. 5. *Narella pauciflora* from G-1111, USNM 52772: A, a complete polyp whorl; B, polyp in lateral view; C, polyp in adaxial view. Stereo views. All scale bars are 0.5 mm.

color, and longitudinally grooved. Polyps are fairly well separated, arranged in whorls of 2–5 (usually 3) and only 6–9 (usually 7) whorls occurring in 3 cm. Thus, the lateral edges of each polyp in a whorl are separated from its adjacent polyps in that whorl by approximately the width of a polyp, and whorls are separated from one another by about 1.5 mm. As is characteristic for the genus, the polyps are pointed downward, measuring 2.6–2.8 mm in length.

Each polyp is protected by 3 pairs of large abaxial body scales and 1–2 pairs of much smaller adaxial buccal scales. The sclerites of the basal pair project at a downward angle of about 70° from the axis, and are about 1.1–1.3 mm in height, only the distal 0.2 mm extending beyond the junction with the medials. The basal scales curve around the body of the polyp but do not meet on the adaxial side. The medials are smaller (about 1.0 mm), projecting at a downward angle of about 25° from the axis. The abaxial buccals are of intermediate size (about 1.15 mm) and much broader than the medials, oriented parallel to the axis or at a slight angle from it, forming a cone that encircles only the very bases of the eight opercular scales. Although somewhat variable, the surfaces of the 3 pairs of large abaxial sclerites are ornamented with prominent ridges, these ridges radiating from a center in the basal third of each sclerite. Otherwise, the outer surface of these sclerites is fairly smooth. The pair of adaxial buccals are square to slightly rectangular in shape and about 0.7 mm in width. They are usually highly ridged, the ridges sometimes reticulate, and have a finely serrate upper edge. Often there is another pair of smaller scales about half the size of the adaxial buccals that are directly proximal to the adaxial buccals, which are also ridged.

The adaxial operculars are tall symmetrical triangles, and are by far the smallest opercular scales, about 1.15 mm in height and 0.35 mm in width (H:W of 2.9–3.3). The inner-lateral operculars have a broad base, which is asymmetrically elongated on

the adaxial side to partially cover the adaxial operculars. These sclerites are up to 1.5 mm in height and 1.0 mm broad at the base (H:W = 1.4–1.5). Outer-lateral and abaxial operculars are even taller (up to 2.0 mm) and about 0.75 mm in width, resulting in H:W of about 1.5–2.0, these sclerites sometimes having 2 or 3 pointed tips. All opercular sclerites are deeply creased medially, edges of adjacent sclerites almost parallel with one another, the crease corresponding to a thick medial keel on the interior surface of the sclerite. Opercular sclerites also bear low, radiating ridges on their outer surfaces, and each adaxial opercular often bears a small (0.15 mm in diameter), short tube on its lower adaxial margin (Fig. 5C) of unknown function. The tentacles contain small, straight granular rodlets 65–90 μm in length and about 15 μm in width. Coenenchymal scales are elongate (up to 1.9 mm), irregular in shape, and ridged, the ridges often radiating from a central point, sometimes longitudinal, and sometimes quite high and reticulate, the latter case most common on those coenenchymal scales adjacent to the basal scales.

Comparisons.—*Narella pauciflora* is perhaps closest morphologically to *N. regularis* (see Table 1), but can be distinguished by its larger polyps, fewer polyps per whorl, fewer polyps per unit distance on a branch, and in often having two pairs of highly ridged adaxial buccal scales.

Distribution.—Antilles and Bahamas (Fig. 7); 738–1473 m.

Remarks.—This is the first report of this species since its original description.

Narella alvinae, new species

Figs. 6E–I, 7, 8A–D

“delicate coral” Calder, 1993:1, 26–27 (color figures).

Material examined/holotype.—25 km NW of Bermuda: $32^\circ 35' \text{N}$, $64^\circ 55' \text{W}$, 3419 m, *Alvin-2566*, 17 Mar 1993: main colony now fragmented into 47 fragments, the largest 27 cm in height with 6 terminal branch-

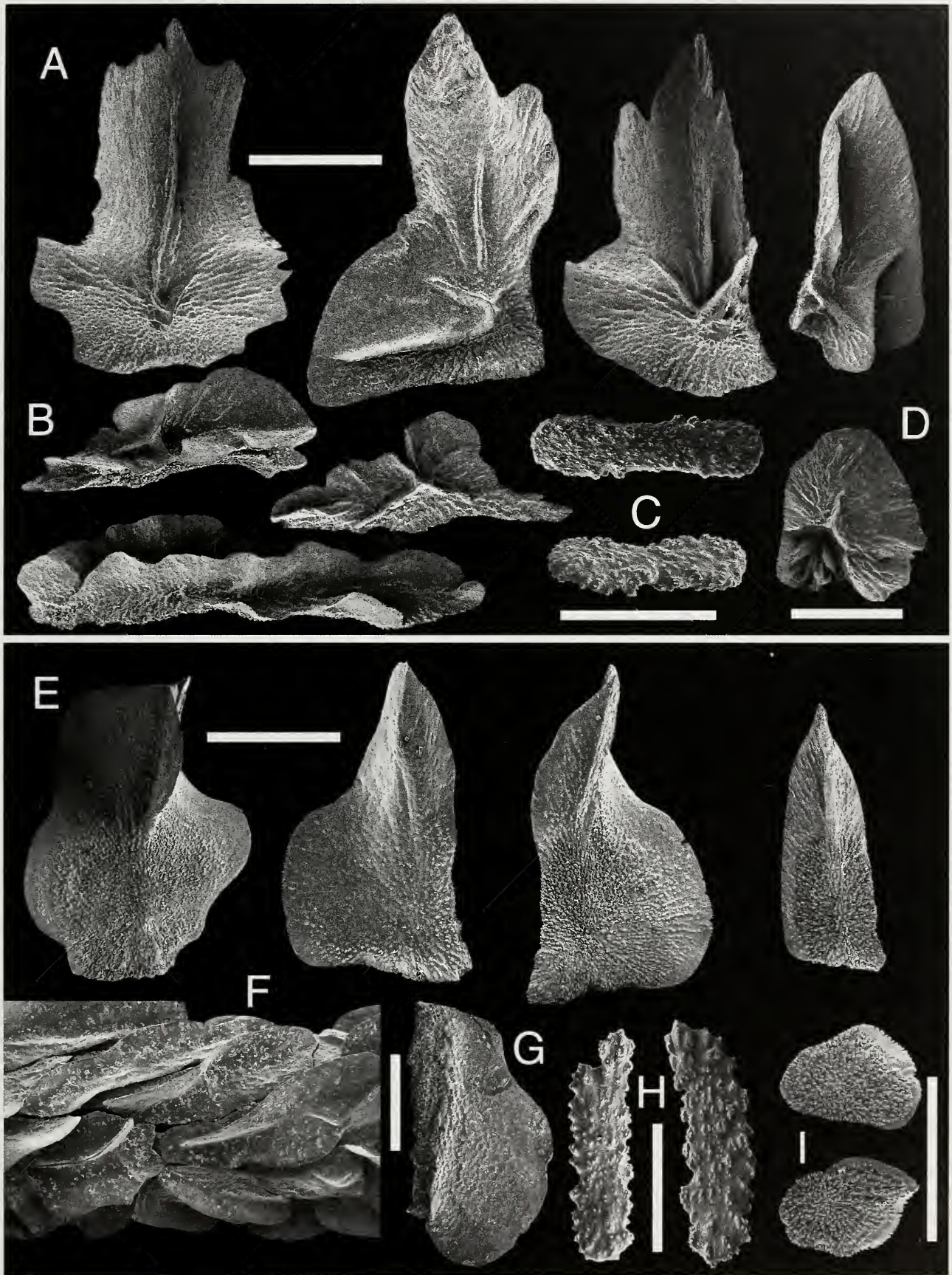


Fig. 6. A–D, *Narella pauciflora* from G-1111, USNM 52772: A, underside of abaxial, outer-lateral, inner-lateral, and adaxial opercular scales; B, three coenenchymal scales; C, two tentacular scales; D, an adaxial buccal scale. E–I, holotype of *Narella alvinae*, USNM 100778: E, underside of abaxial, outer-lateral, inner-lateral, and adaxial opercular scales; F, branch with intact coenenchymal scales; G, an isolated coenenchymal scale with a tall crest; H, two tentacular scales; I, two adaxial buccal scales. Scale bars: A, B, D, E, F, G, I = 0.5 mm; C, H = 0.05 mm.

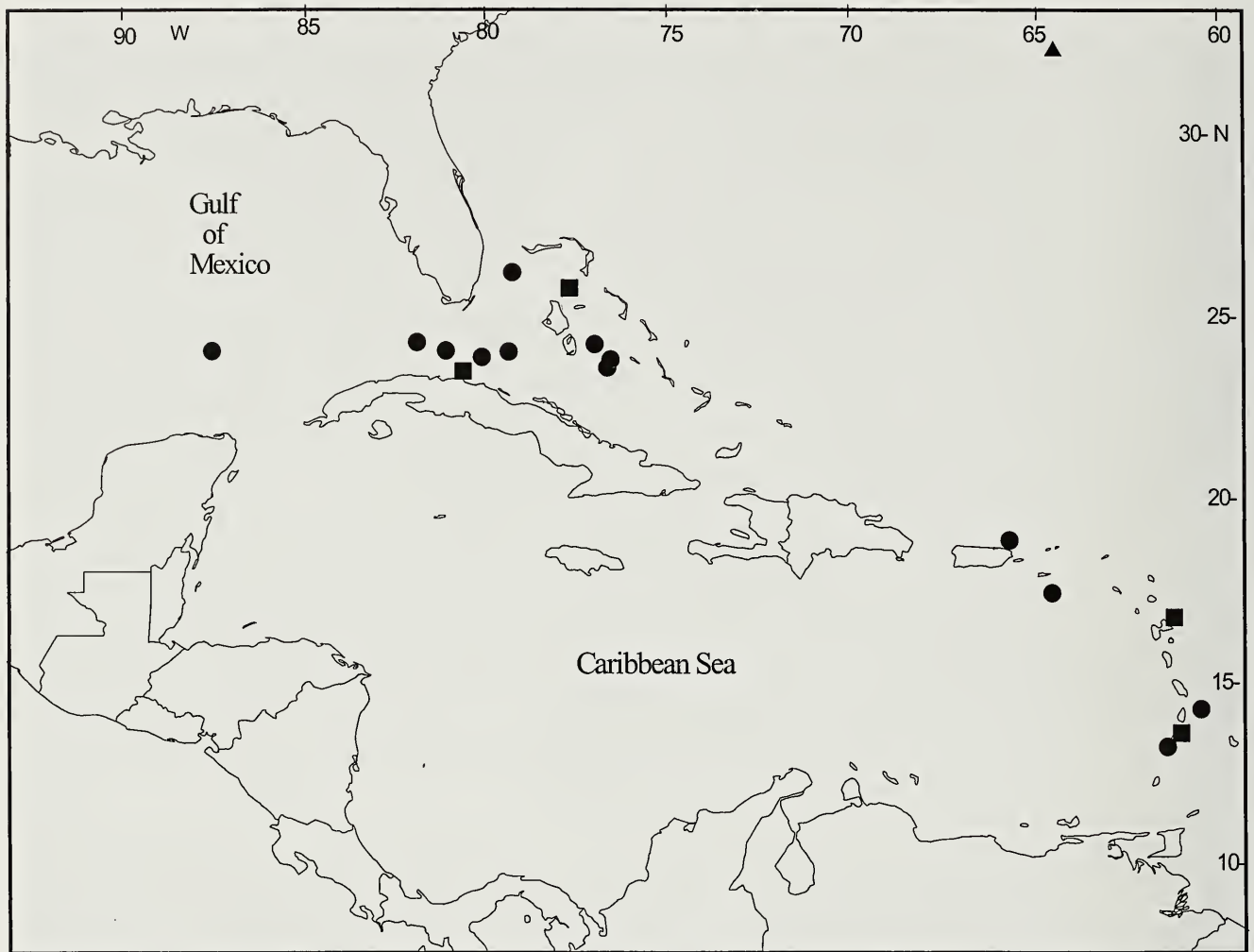


Fig. 7. Distribution of *Narella pauciflora* (circles), *N. regularis* (squares), and *N. alvinae* (triangle).

es, ROMIZ B3521; 12 branches and hundreds of separate polyps, USNM 100778 (SEM C1023-26, 1030), all from the same colony and considered to be holotypic. Type Locality: as stated above.

Description.—The holotypic colony is sparingly and dichotomously branched in one plane, resulting in 26 rather long terminal branches 10–13 cm long. Most of these branches have been broken from the main colony, but the entire colony is figured in situ by Calder (1993). The thickest branch axis is only 0.9 mm in diameter, fairly rigid, smooth, and golden-yellow in color. Polyps whorls are spaced 1.2–1.7 mm apart. There are 4 polyps within each whorl and about 7 whorls occur in 3 cm of branch length. Fully developed polyps are 2.7–3.1 mm in length.

The polyps are covered by 3 pairs of large abaxial scales and 1 pair of adaxial

marginals (buccals), sometimes with a few much smaller adaxials in a more proximal position on the polyp. The sclerites of the abaxial basal pair project perpendicular to the axis and are about 1.7 mm in height, the distal 0.6 mm projecting beyond the junction with the adjacent medials as a prominent lobe, the 2 of which together form a collar around the base of the polyp. Each basal sclerite bears a prominent longitudinal crest up to 0.45 mm in height at the point of curvature from the abaxial to lateral edges of the scale; these scales do not form a complete ring and thus do not touch or fuse on the adaxial side. In fact, the lower proximal edge of each basal sclerite is often slightly notched, the notch fitted to a slightly apically indented coenenchymal scale. Furthermore, the coenenchyme between the basals of 2 adjacent polyps consists of 2 characteristically long (up to

1.8 mm) coenenchymal sclerites that bear unusually tall crests (up to 0.48 mm). The structure and position of the coenenchymal sclerites that surround the basal sclerites is consistent and would appear to “lock in” or stabilize the basal sclerites into the coenenchymal sclerites, the interpolyp scales preventing lateral motion and those at the proximal ends of the basals preventing longitudinal movement, which might explain why in this species it is common for most of the polyps to be abraded from the axis but the basals remaining intact on the axis. The medial sclerites are 1.4–1.6 mm in length, not ridged, and have a thin, transparent, slightly upward curved distal edge. Buccal sclerites are similar to the medials but wider, overlapping only the basal region of the opercular scales. All abaxial scales are coarsely granular exteriorly. A pair of well-developed (0.45 mm in width), flat, rectangular adaxials occur contiguous to the adaxial operculars. In some specimens smaller (0.15 mm), elliptical adaxial sclerites occur lower on the polyp wall.

The adaxial operculars are the smallest of the operculars, symmetrically triangular, up to 1.05 mm in height and about 0.38 mm in greatest (basal) width (H:W = 2.5–2.7). The inner- and outer-lateral operculars are slightly larger (up to 1.4 mm and 0.70 mm in width: H:W = 1.8–2.2), and asymmetrical, the widest point being about a third of the distance from the base caused by a small lobe on the adaxial side of the sclerite. The abaxial operculars are symmetrical, up to 1.4 mm in height and 1.0 mm in width (H:W = 1.23–1.45), widest about a third up from the base cause by symmetrical lobes on either side of the sclerite, and bluntly tipped. All opercular sclerites are deeply longitudinally grooved externally, which corresponds to a prominent keel on their interior surface. The tentacular rodlets are flattened and granular, up to 97 μm in length and 24 μm in width. The coenenchymal scales are thin, slender (0.25 mm), elongate (1.2–2.0 mm) plates, imbricating on their edges, each plate having one thin,

transparent, longitudinal ridge up to about 0.20 mm tall, which gives the branch axis a “frilly” aspect. As mentioned above, the coenenchymal sclerites adjacent to the basals have even taller ridges.

Etymology.—Named in honor of the collecting vessel, the R/V *Alvin*.

Comparisons.—Although similar to *N. laxa* in branching pattern, *N. alvinae* is morphologically most similar to *N. pauciflora* (see Table 1), both species having a similar number of polyps per whorl and whorls per cm, and polyp size; however, *N. alvinae* differs in having prominent lobes on its basal scales, sparse branching, and prominent crests only on the basal scales at the point of curvature from the abaxial to lateral edges. *N. alvinae* appears to be unique in having coenenchymal sclerites with prominent longitudinal crests.

Distribution.—Known only from the type locality off Bermuda (Fig. 7), 3419 m. This is the deepest known record of a *Narella* and one of the deepest collected primnoids on record.

Narella versluysi (Hickson, 1909)

Figs. 1F, 9A–C, 10A–D, 14

Calypterinus Allmanni (*sic*).—Roule, 1896: 303–304.—Versluys, 1906:93.

Stachyodes sp.—Versluys, 1906:93–94.

Stachyodes versluysi Hickson in Stephens, 1909:10–13.—Kükenthal, 1919:456–457; 1924:309.—Thomson, 1927:30–32, pl. 2, fig. 19, pl. 5, figs. 12–13 (in part: not station 970).—Stiasny, 1941:80–81.

Narella versluysi.—Deichmann, 1936: 171.—Grasshoff, 1982a:738, 747 (map 3); 1982b:946–947, figs. 13–14.—Carpine & Grasshoff, 1985:33.—Grasshoff, 1986:27.

Narella elegans Tixier-Durivault & Lafargue, 1968:622–626, figs. 3–4.

Material examined.—Straits of Florida, off St. Lucie Inlet, Florida: 27°06'N, 79°32'W, 677–659 m, G-170, 29 Jun 1963, one unbranched stem 35 cm long, lacking

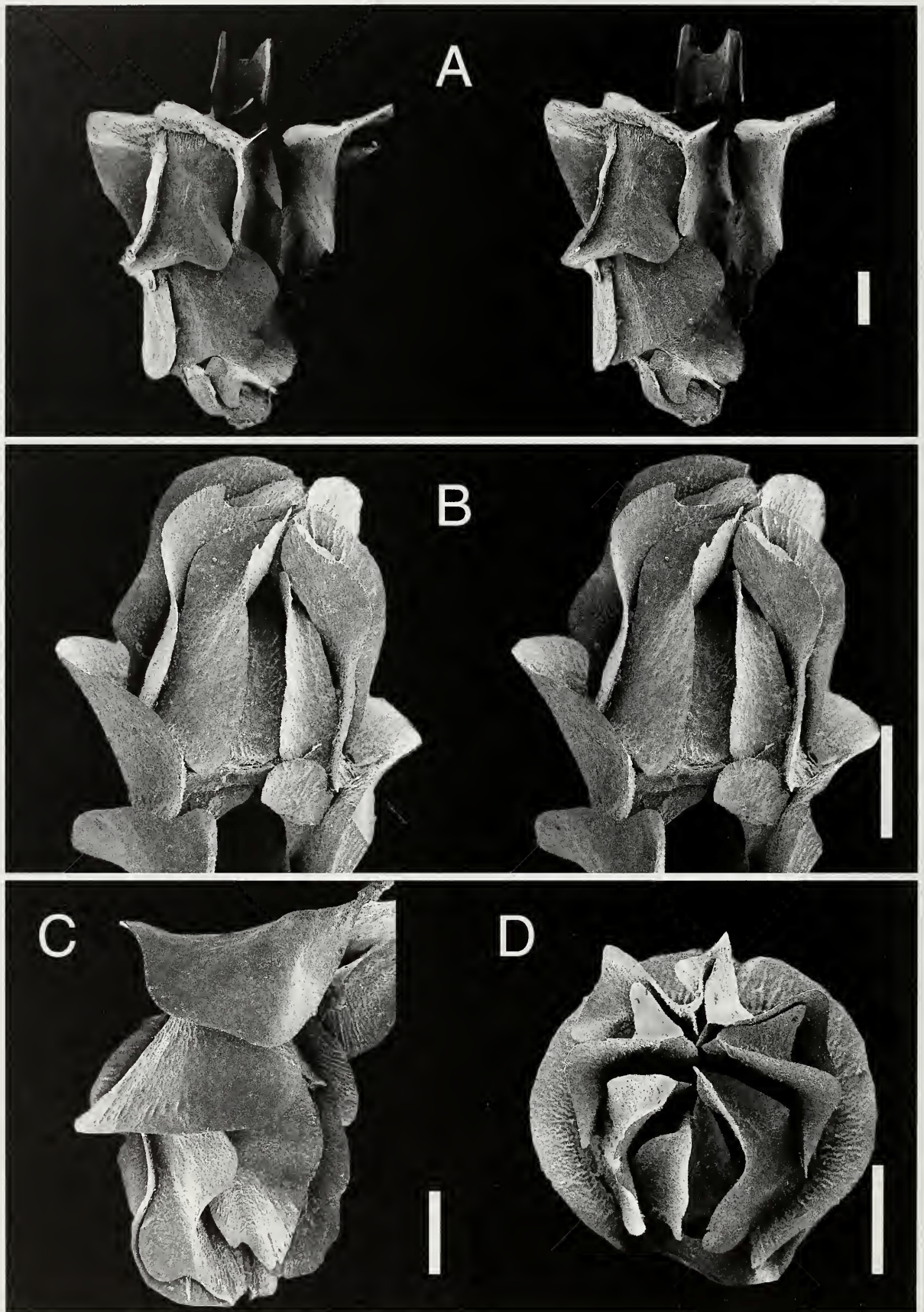


Fig. 8. *Narella alvinae*, holotype, USNM 100778: A, lateral view of polyp; B, polyp in adaxial view; C, lateral view of polyp; D, oral (opercular) view of polyp. A and B stereo views. All scale bars are 0.5 mm.

base and apex, USNM 52900 (unnumbered SEM stub).

Straits of Florida, between Palm Beach, Florida, and Settlement Point, Grand Bahama Island: 26°28'N, 79°33'W, 751 m, G-808, 13 Sep 1966, 2 pieces 5.5 and 12 cm long, probably of a single unbranched stem, lacking base and apex, USNM 52902.

Straits of Florida, off Delray Beach, Florida: 26°24'N, 79°36'W, 738 m, CI-140, 28 Sep 1973, 2 pieces 7 and 37 mm long, probably of a single unbranched stem, lacking base and apex, USNM 57570 (SEM 413, C1014–1015).

Straits of Florida off Delray Beach, Florida: 26°23'N, 79°37'W, 743–761 m, CI-246, 29 Oct 1974, 2 partly decorticated pieces 6 and 24 cm long, apparently part of one unbranched stem, lacking base and apex, USNM 57569.

Straits of Florida west of Riding Rock, Bahama Islands: 25°26'N, 79°23'W, 796 m, G-304, 23 May 1964, 3 unbranched stems, the largest 30 cm long, USNM 52901 (SEM 375).

Off northwestern Cuba: 23°18'N, 80°46'W, 896 m, Atl-3474, 10 May 1939, 2 branches the longest 17 cm, MCZ 3727 and 43647.

Off Bermuda: 32°14.47'N, 64°47.07'W, 900 m, "tangled in crab pot", 15 Nov 1990, one dry branch fragment 9 cm long, USNM 1004792; parent lot 76 cm long, dry, Bermuda Biological Research Station, uncataloged.

Types (see below).

Types.—Five syntypes are deposited at The Natural History Museum, London (1962.07.20.172) and an SEM stub (404) of one of these syntypes is at the USNM. Type Locality: off Ireland; 698–914 m.

Description (western Atlantic specimens).—Colonies evidently are unbranched, straight or nearly so, with a nearly uniform diameter of 5–7 mm (including polyps) and attaining a length up to 34.5 cm (G-170), although eastern Atlantic specimens are known to be as long as 78 cm (Hickson 1909). The axis is heavily calci-

fied, brittle, and longitudinally grooved, with dull golden reflections, in the most robust specimen only 2.2 mm in axial diameter. In one specimen, the proximal part of the axis shows calcareous thickening of the kind present just above the holdfast of many other species. Polyps are fairly closely spaced, the lateral edges of polyps within a whorl touching each other, and the opercular scales of the zooids of one whorl touching (or nearly touching) the basal sclerites of the polyps of the next whorl. Polyps are arranged in whorls of 4–7, and 8–10 whorls occur in 3 cm of branch length. Polyps measure 3.2–3.7 mm in length, measured parallel to the axis from the basal part of the basal sclerites to the apex of the abaxial operculars.

Each polyp is protected by 3 pairs of large abaxial body scales and a variable number of smaller adaxial scales. The sclerites of the basal pair project perpendicular or at a downward angle of 60° from the axis and are about 2.1 mm in height, the distal 0.7–0.8 mm flared outward abaxially as a pair of rounded, smooth-edged, very thin, petal-like processes without marginal points or spines. The inner surface of one or both basal scales may have one or more prominent keels, which may be visible even in abaxial view and which articulate with a notch or groove on the lower side of the adjacent medial sclerite (Fig. 9A). The basal sclerites are smoothly curved around the base of the polyp but do not meet adaxially. The medials are the smallest of the large body wall scales, about 1.2 mm in length and fairly narrow, encircling only about half of the polyp. They also have a free, upturned distal edge that is very thin and delicate, oriented about 45° from the axis. The abaxial buccal scales are of intermediate size (about 1.7 mm in length), oriented parallel to the axis, and also concave in shape, their distal margins thin and flared outward as the other 2 pairs. These buccal scales form a prominent, open collar or cone that encircles only the basal region of the 8 operculars. Except for the internal

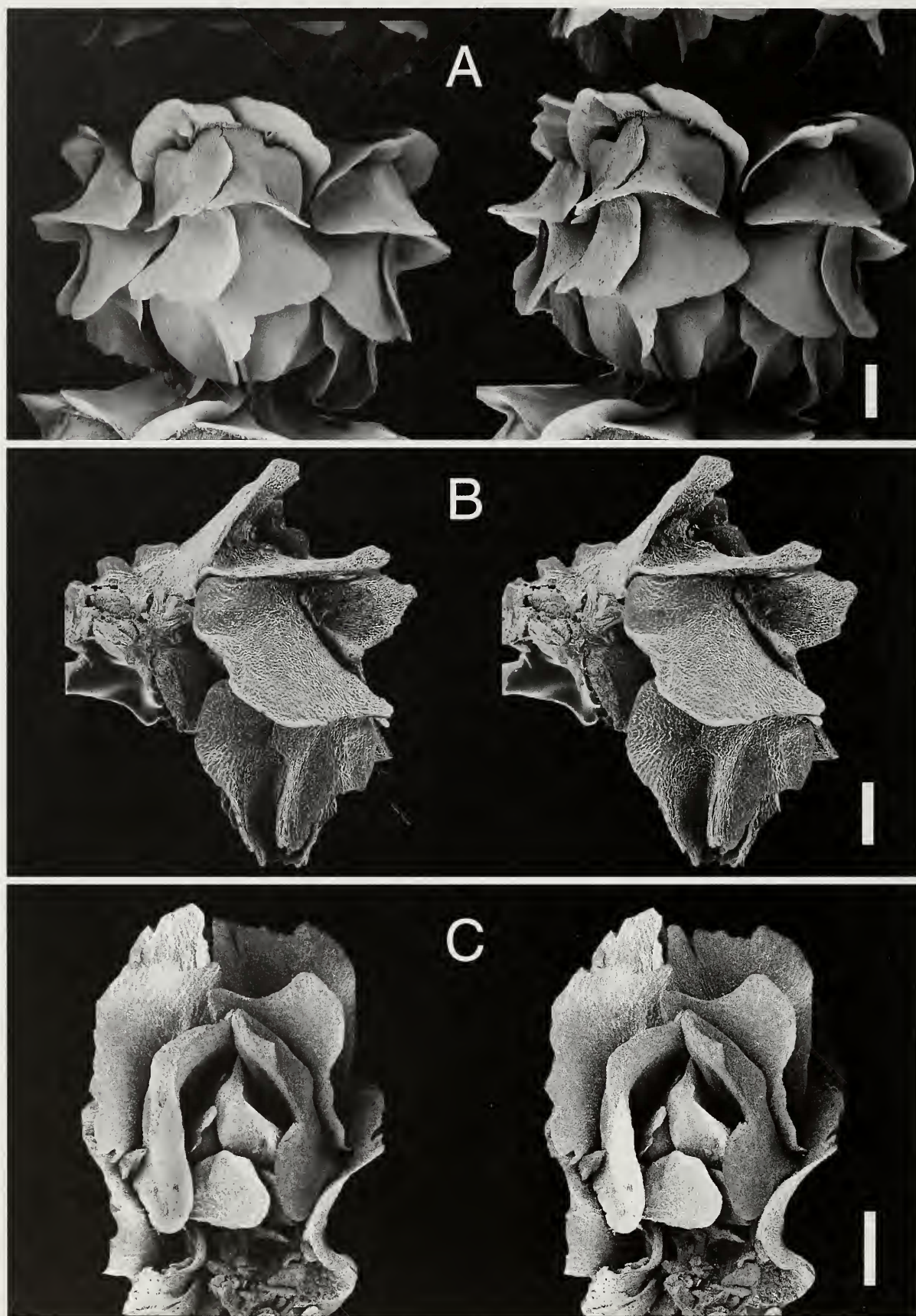


Fig. 9. *Narella versluysi*: A, G-304, USNM 52901, a complete polyp whorl; B, syntype, polyp in lateral view; C, CI-140, USNM 57570, polyp in adaxial view. Stereo views. All scale bars are 0.5 mm.

ridges of the basal scales, the exterior surfaces of the body scales are not ridged or keeled, but covered with a prominent granulation that seems to radiate from a central region of each scale. The adaxial side of each polyp is furnished with a pair of rather large marginal (buccal) scales, quadrate to tear-drop shaped, up to 0.40 mm in diameter, and having finely serrate edges. Additional pairs (up to 5 or 6) of smaller (0.14–0.30 mm width) adaxial scales occur proximal to these two marginal adaxial buccals, their distal margins becoming more coarsely serrate toward the base of the polyp.

As is typical in the genus, the adaxial operculars are the smallest of the opercular scales and shaped as isosceles triangles; they are about 1.0 mm in height and 0.30–0.50 mm in width (H:W = 2.1–3.3), often variable in width within the same polyp, one adaxial opercular being considerably wider than the other. The inner- and outer-lateral operculars are taller and broader, up to about 1.6 mm in height and 0.70–0.95 mm in width (H:W = 1.6–2.1). The abaxial operculars are of a similar height (1.5–1.6 mm), but are wider than the laterals at mid-height (resulting in a H:W of 1.2–1.3), and are blunt-tipped. All opercular scales bear a prominent ridge or keel on the distal half of their interior surface, the keel increasing in prominence in the ad- to adaxial direction, that of the abaxial opercular as much as 0.45 mm in height. The inner- and outer-lateral operculars are asymmetric in shape, each scale having a slightly broader shoulder on the adaxial side of the medial keel; the ad- and abaxial operculars are symmetric in shape. The tentacles are filled with thin, elongate (up to 80 μ m long and 20 μ m width), finely granular rodlets, some of which are curved to conform to the shape of the tentacle. Coenenchymal sclerites are thin and scale-like, up to 1.4 mm in length, and not closely fitted but commonly with one edge flared outward as a thin expansion projecting over neighboring scales and

sometimes with a thin crest on the outer surface.

Comparisons.—Within the Atlantic, a branch fragment of *N. versluysi* could easily be confused with a terminal branch of *N. bellissima*, both species having prominent basal scales, body wall scales with thin distal edges, and a similar number of polyps per whorl (Table 1). But, *N. versluysi* differs in having larger polyps and larger-diameter branches; shorter buccal scales that expose most of the opercular scales; small, stellate adaxial scales; unridged basal scales; and fewer polyps per cm.

Distribution.—Eastern Atlantic: off Ireland, Bay of Biscay, Azores, off Portugal, off western Sahara (Grasshoff 1982a, 1982b); 550–3100 m. Western Atlantic: Bermuda; Straits of Florida (Fig. 14); 677–900 m. The record off Spitsbergen Bank, Arctic Ocean at 48 m (Thomson 1927) is an unlikely locality and depth; Carpine & Grasshoff (1985) implied that there might have been a labelling error associated with this record.

Remarks.—The present specimens agree in the main with Hickson's description of *Stachyodes versluysi* from off the west coast of Ireland. The two obvious differences may be superficial and of no taxonomic importance. First, in the present material, the smallest number of polyps in a whorl ranges from 4 to 7, whereas in the type material the smallest number reported is 9 and the largest "about 14." Although this could be no more than a reflection of colonial size, the diameter of Hickson's specimen at its distal end was not much larger than in the present material but there it had 9 polyps compared with 5 in the present specimens. In regard to number of polyps per whorl, the western Atlantic specimens are more similar to specimens reported by Thomson (1927) from the Azores, which have predominantly 7 or 8 (range 6–10) polyps per whorl or those described by Tixier-Durivault & Lafargue (1968) from the Bay of Biscay as *N. elegans*, which have 4–6 polyps per whorl; however, in the

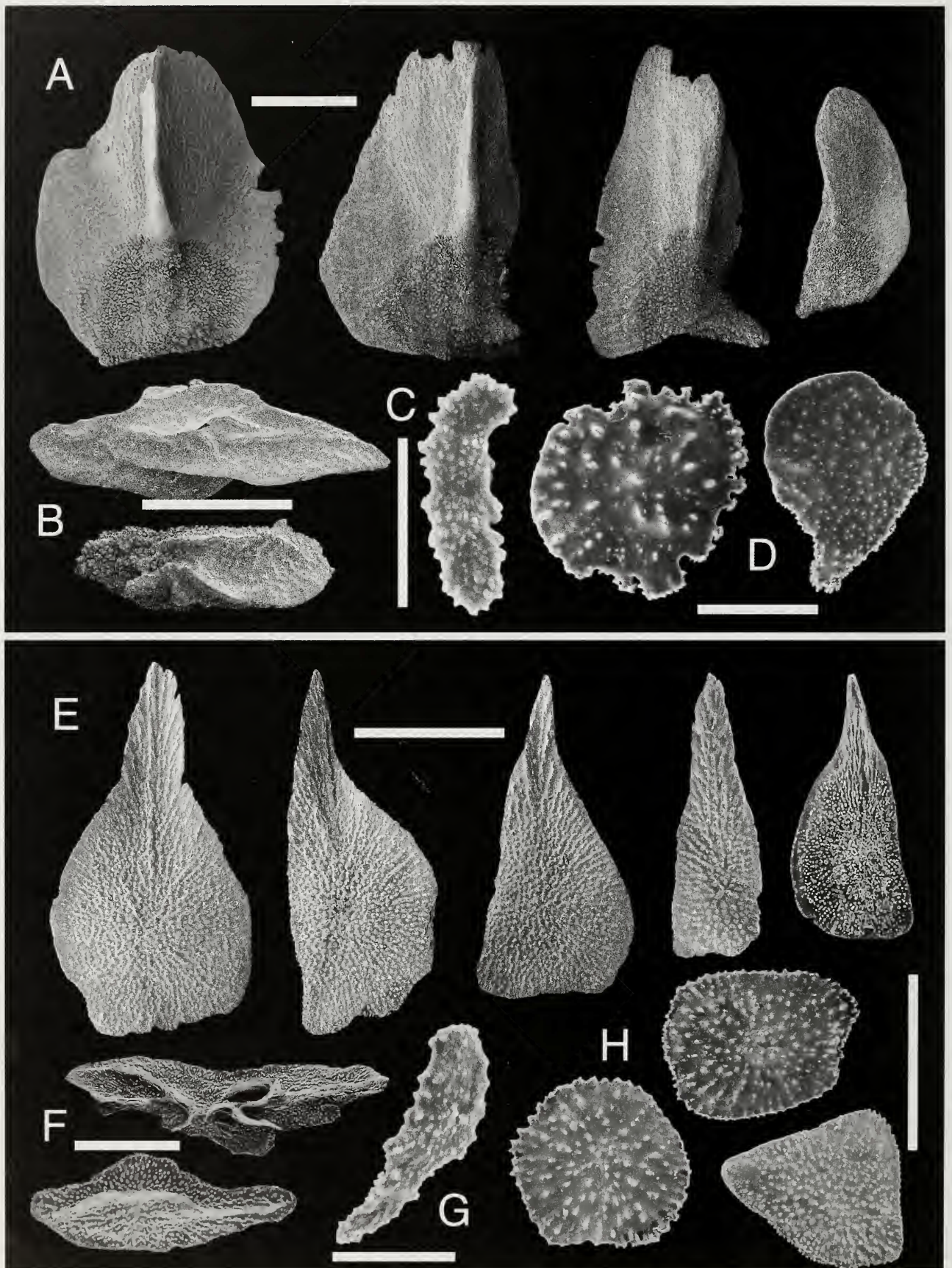


Fig. 10. A–D, *Narella versluysi* (A, B, CI-140, USNM 57570; C, D, G170, USNM 52900): A, underside of abaxial, outer-lateral, inner-lateral, and adaxial opercular scales; B, two coenenchymal scales; C, a tentacular scale; D, two adaxial buccal scales. E–H, holotype of *Narella laxa*, USNM 11853: E, upperside of abaxial, outer-lateral, inner-lateral, and two adaxial opercular scales; B, two coenenchymal scales; C, a tentacular scale; D, three adaxial buccal scales. Scale bars: A, B, E, F = 0.5 mm; C, G = 0.05 mm; D (right), H = 0.25 mm; D (left) = 0.09 mm.

latter case the polyps are also smaller, only 2.5 mm in length. But, Grasshoff (1982b) considered a polyp length range of 2.5–4.0 mm to be within the intraspecific range for this species. A second difference appears in the coenenchymal plates, which in *S. versluysi*, according to Hickson (1909:11), are large “compound” plates over 1 mm long, which break down into smaller “oblong, square, leaf-shaped, stellate and quite irregular” scales upon prolonged treatment with caustic potash. Perhaps by this drastic treatment (not used in the present study) Hickson was merely breaking up fully developed scales that may have been weakened by rough handling during collection.

J. A. Thomson’s description (1927:30) of 18 specimens from the Josephine Bank and off the Azores also agrees in general both with Hickson’s account and with the present western Atlantic material. However, the weak lateral crests on the basal scales described by Thomson but not evident in his beautifully drawn figure of an isolated polyp (1927:pl. 2, fig. 19), casts some doubt on the identification of his specimens as *Narella versluysi*. Two small pieces of Hickson’s type specimen, which one of us (FMB) has examined in The Natural History Museum (London) through the kindness of Dr. P. F. S. Cornelius, show no trace of crests on the basal scales, although adjacent coenenchymal scales definitely have crests.

Previously known only from the eastern Atlantic, this is the first report of this species from the western Atlantic. Although generally assumed to be an unbranched species, some authors have qualified this description to include “slightly branched”. Indeed, very few, if any, colonies have been collected intact including a holdfast, and thus the nature of its branching is difficult to verify.

Narella laxa Deichmann, 1936

Figs. 1E, 10E–H, 11A–C

Narella laxa Deichmann, 1936:170, pl. 26, fig. 1.—Grasshoff, 1985:305.

Material examined types.—South of Georges Bank: 40°34′18″N, 66°09′00″W, 3186 m, bottom temperature 3°C, *Alb*-2573, 2 Sep 1884: one dry colony 14 cm high and 6 cm wide, with a detached branch, USNM 11853 (holotype) (SEM 410, 411, C1027-28). Type locality: as stated above.

Same data: One fragment 1.5 cm long, with 4 whorls only, in alcohol. From the same haul as the holotype and probably a piece of it. The preservative has at some been slightly acid, as the sclerites are chalky in appearance and extremely fragile, USNM 49426.

Same data: one fragment 2.8 cm long, with 7 whorls; dry, glued to a piece of black cardboard. From same haul as holotype and undoubtedly a piece of it, MCZ 4811.

Description.—The large holotypic colony is sparingly branched in one plane, the short (5.4 mm tall and 1.6 mm in diameter) main stem dichotomously dividing, the remaining divisions all occurring within 15 mm of the first bifurcation, resulting in 9 undivided terminal branches 10–13 cm in length. The axis is stiff, brittle, smooth, light yellowish brown with scant indication of metallic luster in dry condition. Polyp whorls are fairly well spaced, a distance of about 2.5 mm separating each whorl, the polyps within a whorl touching laterally. Polyps are arranged in whorls of 3–5, of which 5–7 (or even 8 in places where whorls of young polyps are present between older ones) occur in 3 cm of branch length. Fully developed polyps are about 3 mm long, measured parallel to the axis; younger individuals are about 1.75 mm long.

The polyps are covered by 4 pairs of large abaxial body scales (1 pair of basals, 2 pairs of medials, and 1 pair of buccals), 2–3 pairs of smaller adaxial scales, and occasionally one or more inner-lateral buccal scales. The sclerites of the basal pair project perpendicular to the axis, and are about 1.4 mm in height, the distal 0.4 mm extending as short, rounded lobes beyond the junction with the first medial pair. The basal sclerites

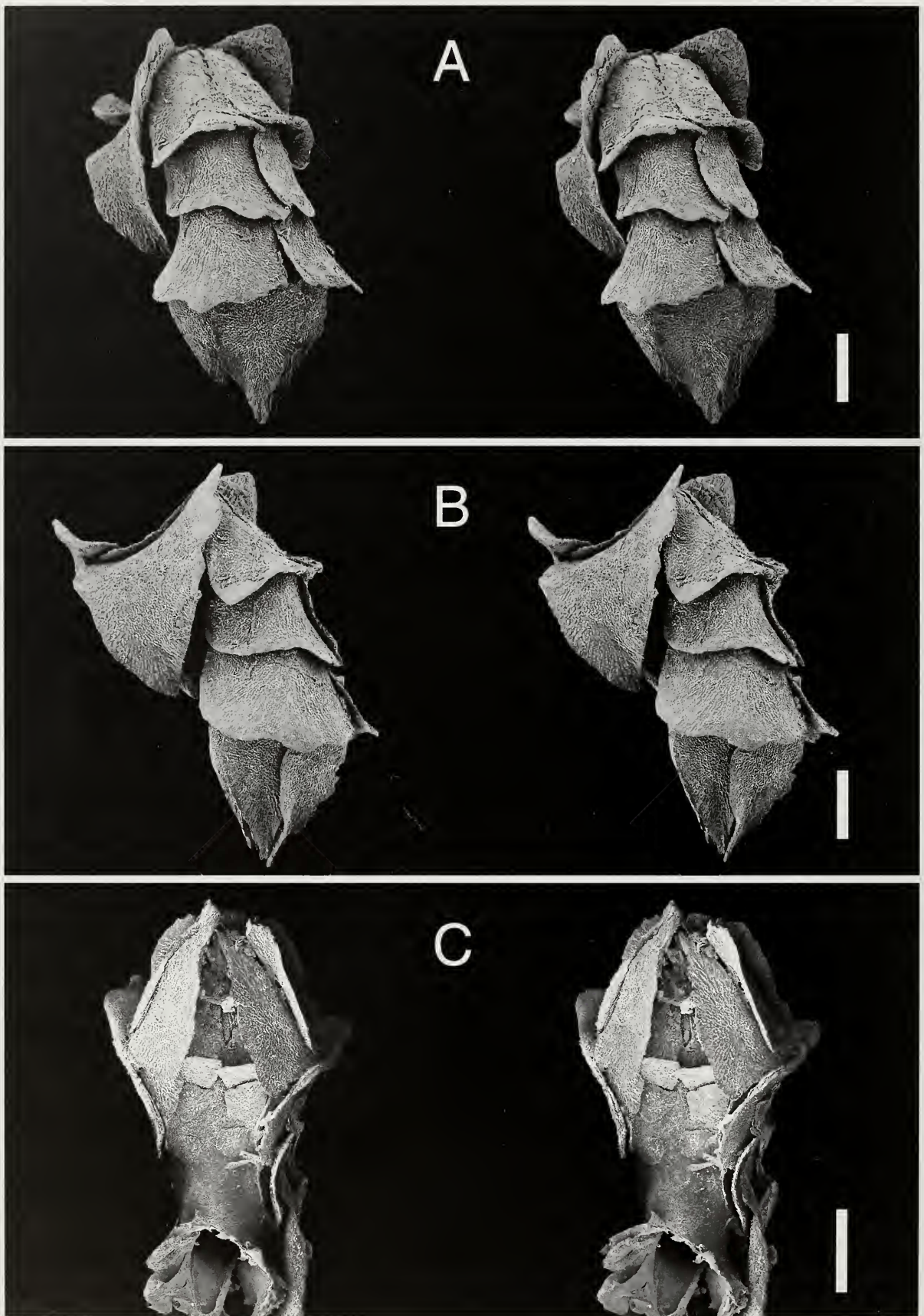


Fig. 11. *Narella laxa*, holotype, USNM 11853: A, abaxial polyp view; B, polyp in lateral view; C, polyp in adaxial view. Stereo views. All scale bars are 0.5 mm.

are smoothly curved around the base of the polyp, are not ridged, and do not meet adaxially. The 2 pairs of medial scales and the pair of abaxial buccals are progressively longer and wider toward the distal end of the polyp, the buccals almost encircling the polyp; however, in some polyps there are one or 2 medium-sized (0.35–0.43 mm in width) inner-lateral buccals that intercalate with the abaxial buccals and the adaxial buccals. The extra pair of medial scales allows for a slightly more flexible polyp than in most other species of *Narella*, the opercular scales usually directed straight toward the axis in a preserved polyp. The buccal scales cover only the basal-most region of the opercular scales. None of the larger body scales are ridged or crested, but all bear a coarse granulation that is arranged in lines radiating outward from the nucleus. Two or three pairs of well-developed, rectangular adaxial buccals lie below the adaxial operculars, those closest to the operculars about 0.30 mm in width, those more proximal, decreasing to about 0.15 mm in width. The distal edges of these scales are finely serrate.

The adaxial opercular scales are the smallest of the operculars, shaped as slender triangles 0.70–0.85 mm in height and 0.20–0.24 mm in basal diameter (H:W = 3.3–4.2). The inner- and outer-lateral operculars are larger, up to 1.1–1.2 mm in height and 0.51 mm in basal width (H:W = 2.1–2.5), the base asymmetrically extended on the adaxial side. The large abaxial operculars are symmetrical, about 1.0–1.3 mm in height and 0.65–0.70 mm in basal width (H:W = 1.8–1.9). The opercular scales are fairly flat becoming only slightly concave on their distal regions, which corresponds to but a weak keel on the internal side. The tentacles contain curved, granular rodlets up 0.105 mm in length. The coenenchymal scales are elongate (up to 1.10 mm in length), more or less imbricating, commonly with a prominent longitudinal crest.

Comparisons.—Only one other species

of *Narella* at present known has 4 pairs of body scales, *N. spectabilis* n. sp., described below. It differs in the presence of distinct longitudinal crests on all the abaxial body scales, prominently keeled operculars, finer and smoother external sculpturing, and more elaborately crested coenenchymal scales (see also Table 1). *N. laxa* is also distinguished from all other western Atlantic species by having virtually flat opercular scales with rudimentary ventral keels, the opercular scales of all other species being strongly concave above.

Distribution.—Western Atlantic: known only from the type locality (see Material Examined) near Balanus Seamount, New England Seamount Chain, off Georges Bank; 3186 m. Eastern Atlantic: Shamrock Canyon, Bay of Biscay, 2980 m (Grasshoff, 1985).

Remarks.—Verrill, in his original manuscript on the Alcyonaria of the *Blake* and in the captions of his unpublished plates (Verrill, unpub.), generically separated *N. laxa* from the other species of *Narella*, which have only 3 pairs of large abaxial body scales. The discovery of another species with 4 pairs of scales lends support to that view, but clarification of this matter must await the study of a great deal more material than is available at present.

Narella spectabilis, new species

Figs. 1C, 12A–C, 13A–D, 14

Material examined/types.—Holotype: Tongue of the Ocean, Great Bahama Bank: 24°30'N, 77°22'W, 1485 m, CI-125, 25 Sep 1973, one unbranched stem partly decorticated and lacking distal tip and holdfast, USNM 57578 (SEM 407–409, 411, 416, C1029). Type Locality: as stated above.

Description.—The holotypic colony is 25 cm long and unbranched, but, because it is a fragment, it cannot be certain if this branch represents an unbranched species, like *N. versluisi*, or is an end branch of a sparingly branched species, such as *N. laxa*. The axis is 0.9 mm in diameter, stiff, brittle,

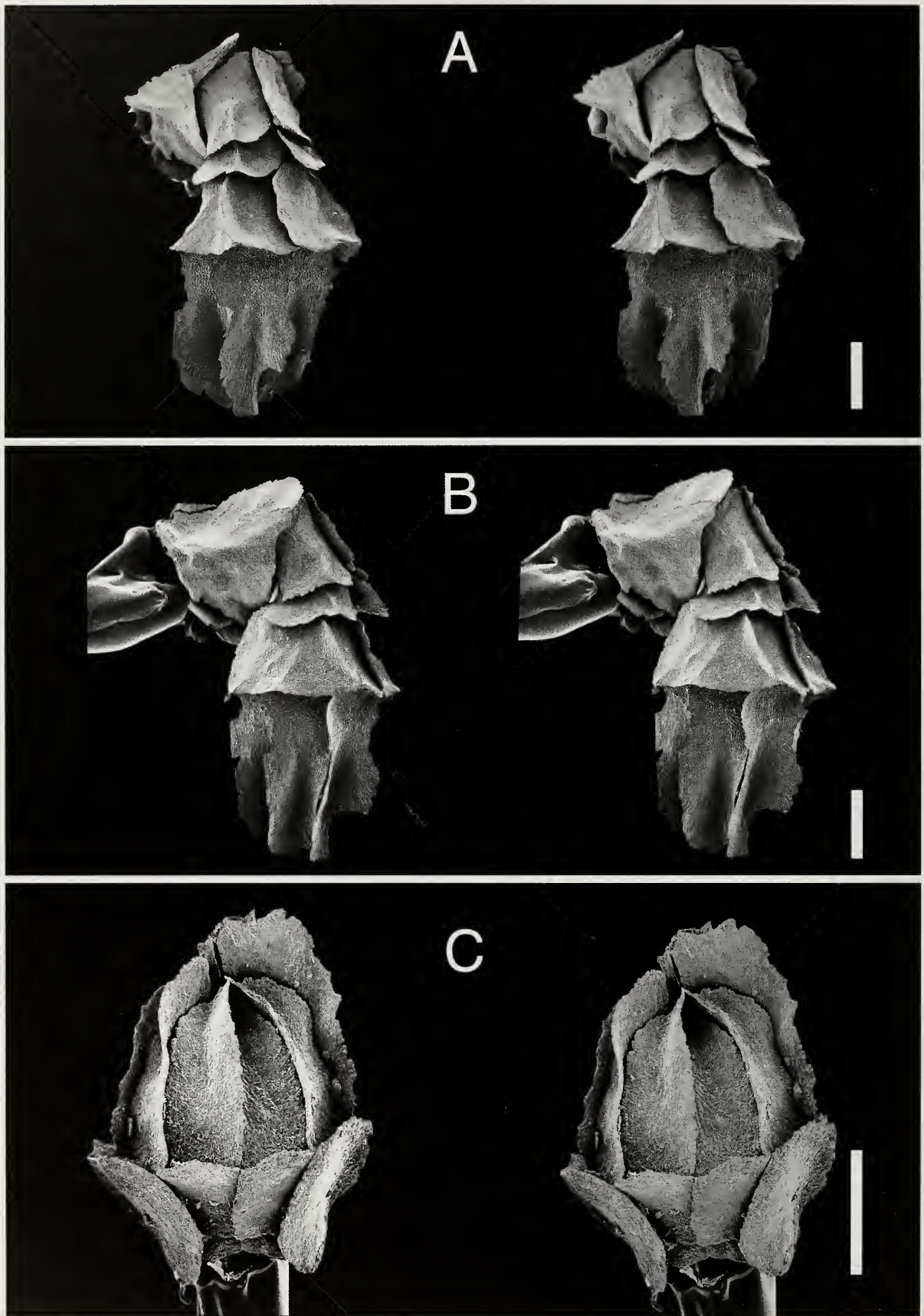


Fig. 12. *Narella spectabilis*, holotype, USNM 57578: A, polyp in abaxial view; B, polyp in lateral view; C, polyp in adaxial view. Stereo views. All scale bars are 0.5 mm.

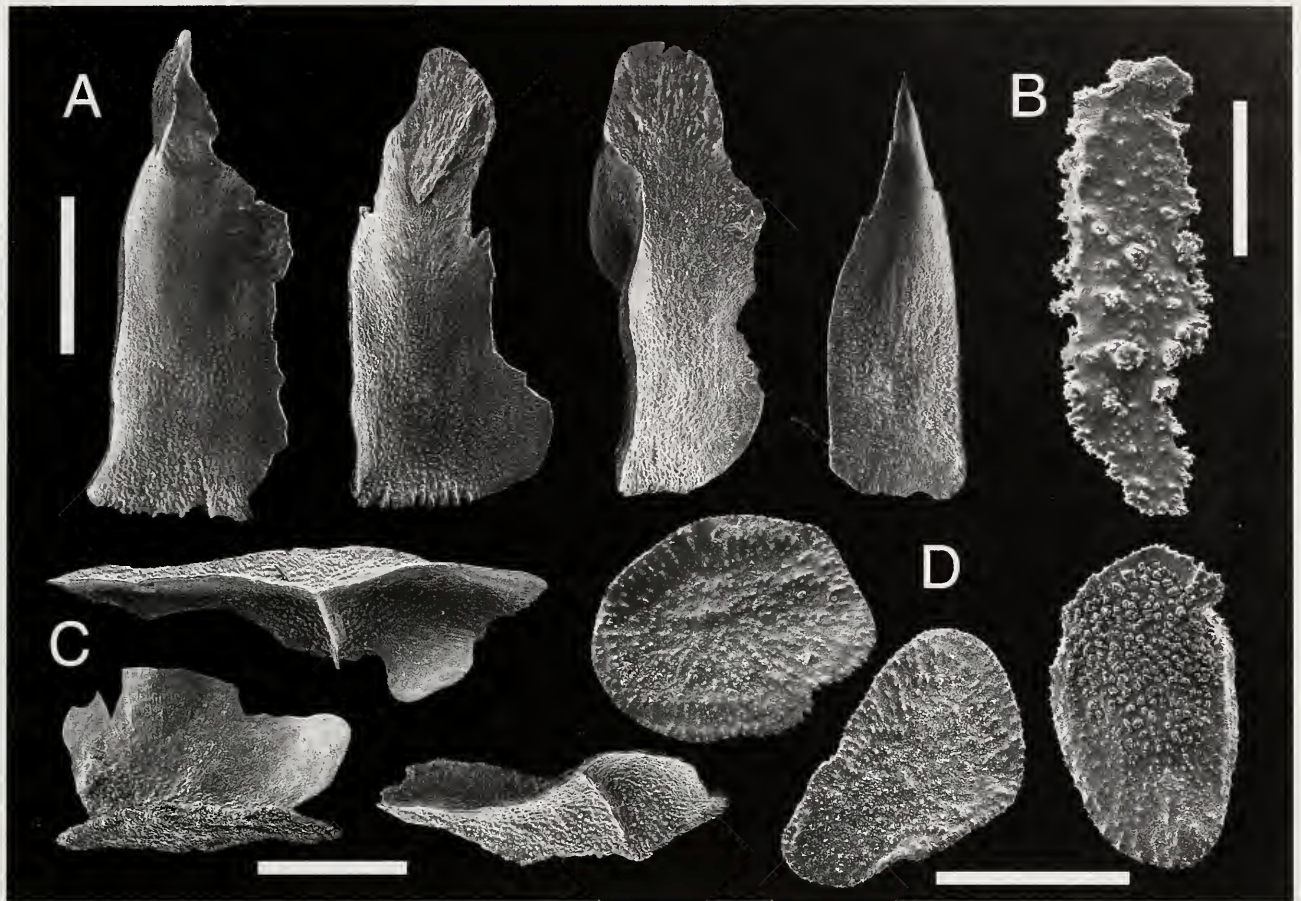


Fig. 13. A–D, holotype of *Narella spectabilis*, USNM 57578: A, upperside of abaxial, outer-lateral, inner-lateral, and adaxial opercular scales; B, a tentacular scale; C, three highly crested coenenchymal scales; D, three adaxial buccal scales. Scale bars: A, C = 0.5 mm; B, 0.05 mm; D = 0.25 mm.

yellowish white with pale golden reflections, and nearly smooth, with only the faintest suggestion of longitudinal grooving. Polyp whorls are not directly adjacent, but separated by about 0.5 mm from one another. Polyps are arranged in whorls of 4, of which 8 occur in 3 cm of branch length. Fully developed polyps are 3.5 mm in length.

The polyps are covered by 4 pairs of large abaxial body scales (1 pair of basals, 2 pairs of medials, and 1 pair of buccals) and 2 pairs of smaller adaxial buccals. The sclerites of the basal pair project perpendicular to the axis, and are about 1.15 mm in height, the distal 0.20 mm extending slightly beyond the junction with the proximal ends of the first medial pair. Each basal sclerite bears a prominent longitudinal crest up to 0.25 mm in height corresponding to the right angle curve it makes as it wraps around the lateral side of the polyp. The

basal sclerites decrease in width toward the adaxial side where they meet to form a complete ring but do not fuse. The operculum is prominent, about $\frac{1}{3}$ the length of the contracted polyp. The 2 pairs of medials and the abaxial buccal pair are about the same length (about 0.75 mm) but progressive wider toward the polyp tip, the buccals almost encircling the polyp. The second pair of medial sclerites is largely overlapped by the first (more proximal pair). Like the basals, these body wall sclerites are also longitudinally ridged along their midline, corresponding to the right angle curve around the lateral side of the polyp, but the ridges are much less prominent, and in the case of the buccals one or more shorter accessory ridges may be present. The buccal scales cover only the basal-most region of the large opercular scales. The longitudinal ridges and crests are aligned among the 4 pairs of body scales, all oc-

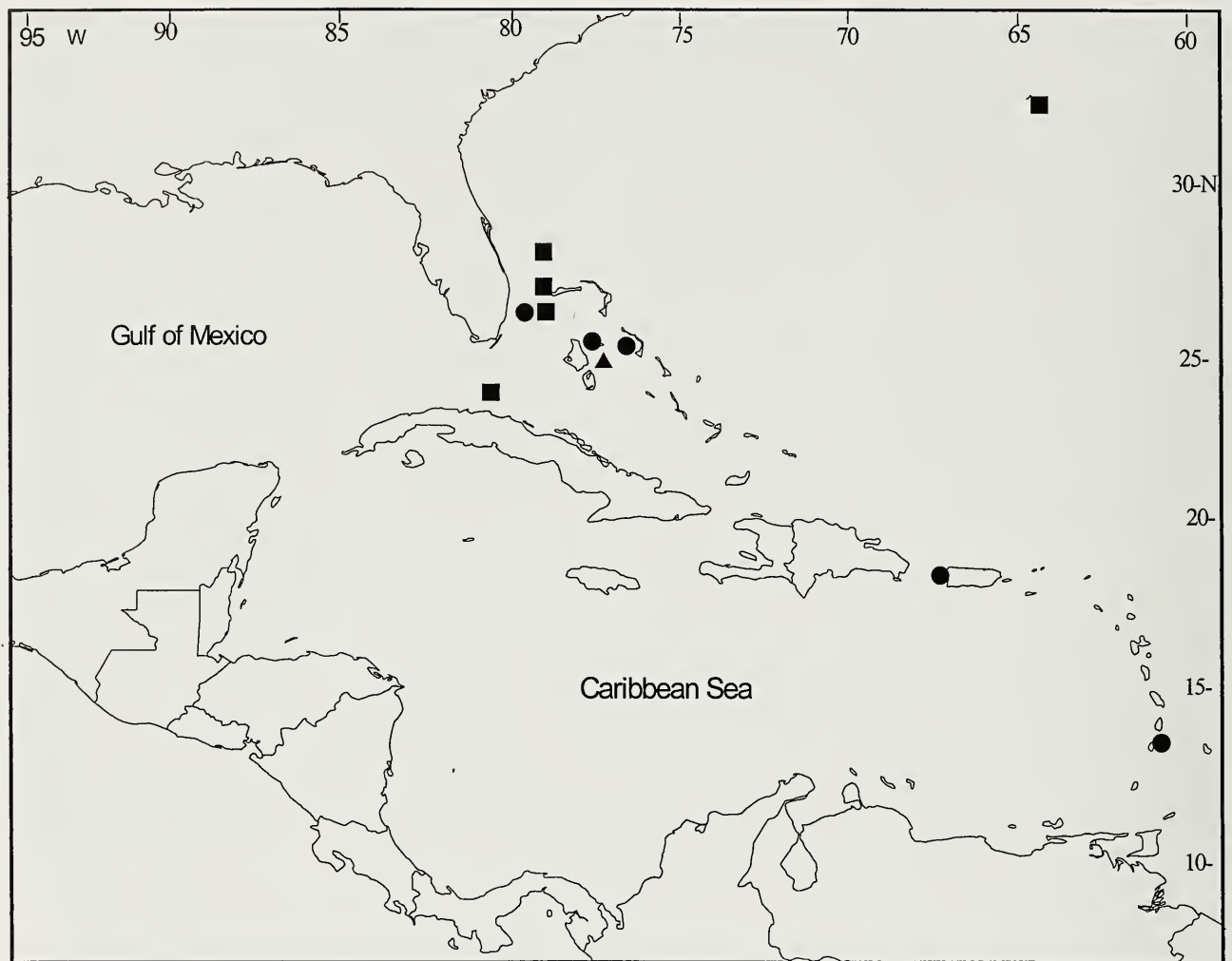


Fig. 14. Distribution of *Narella bellissima* (circles), *N. versluysi* (squares), and *N. spectabilis* (triangle).

curing at the right angle curve leading to the lateral side of the polyp wall, giving the polyp a polygonal shape in cross section. One might expect a corresponding linear depression on the underside of the sclerite which would align and allow the ridge of the more proximal sclerite to slid over it, but such depressions were not observed. All body scales are externally ornamented with fine, smoothly rounded granules arranged in lines radiating outward from a nucleus near the center of each sclerite. Two pairs of well-developed square to rectangular adaxial buccal scales are present, the marginal ones being quite large (up to 0.4 mm in width) the second pair about half this size, the distal edges of which are finely serrate.

The adaxial opercular scales are the smallest of the operculars, shaped as slender triangles but deeply concave exteriorly (essentially spoon-shaped), up to 0.85 mm

in length and 0.35 mm in basal width (H:W = 2.4–3.2). Inner- and outer-lateral operculars are slightly longer (up to 1.3 mm in height and 0.50 mm in greatest width, H:W about 2.35) and are fairly symmetrical in shape, also highly concave but not spoon-shaped. Abaxial operculars are the largest opercular scales, up to 1.5 mm in length and unusually narrow (e.g., 0.6 mm, resulting in a high H:W of 2.1–2.6). The abaxial operculars sometimes have two additional apices in addition to the main apex (Fig. 13A). Thus, all opercular scales are roughly the same shape, but of increasing size in the ad- to abaxial direction. They all bear prominent longitudinal keels on their interior surfaces. The tentacles contain rotund granular rodlets up to 0.15 mm in length and 45 μ m in diameter. The coenenchymal scales are thin, elongate, more or less imbricating, usually with a thin longitudinal

crest, the crests of those coenenchymal scales adjacent to polyps being extremely tall (e.g., up to 0.45 mm).

Etymology.—Latin *spectabilis* = remarkable, notable.

Comparisons.—Only one other species of *Narella*, *N. laxa*, has four pairs of large body wall scales. *N. spectabilis* differs from that species in having longitudinal ridges on all body wall scales, a closed ring of basal scales, more slender and deeply concave opercular scales with a high H:W ratio, and would appear to be unbranched.

Although *N. spectabilis* appears to be related also to *N. studeri* (Versluys), *N. parva* (Versluys), and *N. bowersi* (Nutting), those species have only three pairs of body scales, with crests on only the basal pair.

Distribution.—Known only from the type locality of The Tongue of the Ocean, Bahamas (Fig. 14), 1485 m.

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